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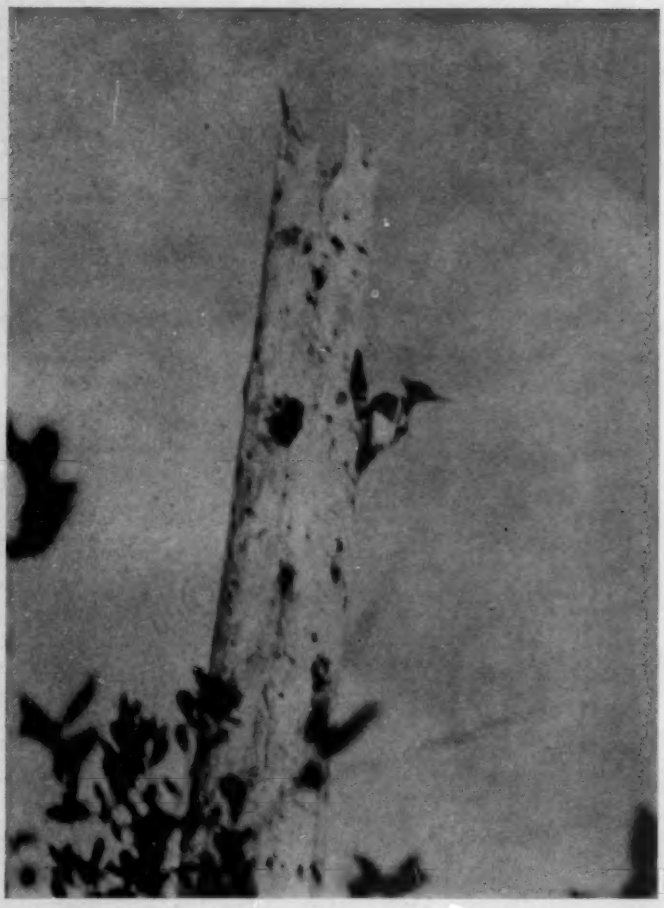

MALE CUBAN IVORY-BILLED WOODPECKER PREPARING TO ENTER NESTING CAVITY. THE LOWER HOLE APPEARED TO CONNECT WITH THE MAIN CAVITY.

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A LAST REMNANT OF IVORY-BILLED WOODPECKERS IN CUBA

BY JOHN V. DENNIS

Plate 13

IT IS interesting to observe that Ivory-billed Woodpeckers, *Campephilus principalis* and *bairdii*, at the present time should be in final stages of becoming totally extinct in the two parts of the world where they occur, Cuba and the southern part of the United States. The last known colony of American birds (on the Singer Tract in Louisiana) has apparently disappeared. Barring the unlikely possibility of a new colony being discovered, the American bird is now extinct except for a few stray individuals. The fate of the Cuban bird, until this report, was generally unknown outside of Cuba. A pair had been collected in the Sierra del Cristal of Oriente Province about 1907 by Dr. C. T. Ramsden. He also found a nest. In this same range a Swedish botanist, Eric Ekman, saw a few individuals about 1920. Bond (1947) gives the probable range of the species at the present time as the Sierra del Cristal and the Sierra de Moa in northern Oriente. Barbour (1943) considers the bird virtually extinct and adds that "a few pairs may possibly still be living in the pine-clad highlands of Mayarí . . . " Speaking of the range of the Ivory-bill during Gundlach's time (the last half of the nineteenth century), Barbour states that it was "to be found in the Organ Mountains north of San Diego de los Baños, in the high woods about the Ensenada de Cochinos, where the memory of the 'Carpintero Real' persists, as well as near Guantánamo." He (Gundlach) collected traditions of still earlier occurrence in Banagüises, Calimete and along the Hanábana.

My interest in the fate of the Cuban bird was aroused by Mr. Davis Crompton of Worcester, Massachusetts, who has made several trips

to the South in efforts to locate colonies of the American Ivory-bill. Mr. Crompton had made inquiries concerning the Cuban bird, and we were fortunate in receiving letters, giving us detailed information about a colony at an undisclosed site, "somewhere in Cuba." Since we are obligated to keep secret all information that might lead to the discovery of any remaining Ivory-bills, all place names are omitted from this paper as are the names of birds having a restricted range. We are entirely in sympathy with this restriction since what little chance the Cuban birds have depends to a large extent upon their isolation and freedom from molestation by trophy hunters and collectors.

Our information came from a man who had the welfare of the birds at heart and who took steps toward their protection. Unfortunately he is no longer present in the region in which the birds occur. The largest number he saw was a group of six, this in 1941. The group followed him through the woods for some distance, exhibiting great curiosity. In the same year he observed a nesting site in a dead pine. Interestingly enough, a young bird, still unable to fly, was brought to him by some lumbermen. It was fed "white grubs, these being procured by a man who was paid to chop them out of dead pine logs." When the bird was able to fly, it was released. Our informant kept track of several pairs, one of which nested at the same site for two seasons. He did not know the exact status of the birds at the present time, but thought that lumbering activities had probably reduced their numbers or had driven them to more remote districts. Although we had no assurance that we would find any living birds, we thought that there was enough probability to warrant a try. So it was that we left for Cuba in April of 1948 in the hope that we would see and photograph the Cuban Ivory-billed Woodpecker before the species was extinct.

After arriving at our destination, we spent several days exploring the country in all directions from our headquarters. The mountainous terrain here was largely covered by a broad belt of pine. The pine gave way to a splendid deciduous forest which was in the process of being ruined by lumbering activity and fire. The pine forest had already been ruined, only dead and defective trees remaining. Adding to the devastation, were forest fires which burned unchecked. The lumbermen did not bother to put out their cigarettes but tossed them into the dry underbrush. A view of the mountains always revealed columns of smoke rising from a dozen or more points. No attempt, whatsoever, was made to put out any of the fires. The country was almost empty of inhabitants, but here and

there squatters had moved in. Their huts, made of thatched palm fronds, stood in the middle of bleak clearings where every single tree had been felled, with the exception of royal palms, if any existed.

At first we made little mention of the Ivory-bill or 'Carpintero Real.' We did not want to attach too much importance to the bird as this might induce people to kill them in the belief that there was some value in a dead bird. But as our early explorations bore no fruit, we began to make some careful inquiries. We soon learned that almost any woodpecker was called a "carpintero real." Our suspicions then were that very few people working or living in this region knew the Ivory-bill. This assumption proved correct when we later found that of several dozen lumbermen, only two could describe the bird. But after a good deal of inquiry, during which we showed equal interest in Cuban todies, trogons, parrots and the like, we learned of an area where woodpeckers, almost certainly Ivory-bills, occurred. We were told that the birds were seldom seen, being active only during the early morning and toward evening.

The region to which we had been referred was one made up of pine forest with an understory of palms and grasses. There was a sprinkling of deciduous trees, some quite large. Although this region had been heavily logged and burned over as well, growth was quite luxuriant in spots. A watercourse, as well as the generally rugged terrain, had prevented a clean sweep of all the timber. The pine trees, on the whole, were limited to less than five inches in diameter. Numerous dead pines, often ten or more inches in diameter, were still standing.

Almost as soon as we entered this region, we found fresh Ivory-bill diggings in small and defective pine trees. Walking along old lumber trails, we shortly heard calls which sounded like descriptions of the Ivory-bill note. Leaving all our equipment as well as our guides behind, we plunged into thick growth, hoping for a quick termination to our search, now entering its fifth day. Presently all hopeful sounds ceased. We were left without a clue as to what direction to follow. For several hours we penetrated along a ridge, finally coming to a point where we had a good view of the valley below. At this point we separated; I made my way to a vantage point where I could watch for birds in flight and Mr. Crompton remained in the same spot to get some rest or sleep after our fatiguing climb. Within fifteen minutes Mr. Crompton was awakened by the calls of an Ivory-bill in near-by trees while, in the mean time, I spotted a second bird engaged in shredding bark from a small pine. Either both these birds were females, as their black crests suggested, or one of them was a female (this we later established) and the other was an immature male.

They were 'barking' the small pine trees in search of food. While I returned for my camera, Mr. Crompton followed the bird which proved to be a female as she made her way leisurely down the ridge. After several hundred yards, she came to some dead pine stubs and lingered in this vicinity. When I returned, I saw not only this bird, but also a male leaving a cavity in one of the dead pines. It soon became obvious that we had stumbled upon a nesting site.

Our observations at the site lasted from about 1:00 P. M. until 5:00 P. M. We were unable to return again to this spot so that my data are quite fragmentary, to say the least. But in as much as virtually nothing has been written on the habits or nesting of the Cuban Ivory-bill, I offer my notes as a slim beginning. Ironically, these notes may be the last, due to the precarious status of this species.

All persons who gave us assistance and supplied us with information can not be mentioned in this text. One of these persons, a citizen of the Republic of Cuba, gave us invaluable aid as a guide—this without asking for remuneration. I am able to acknowledge publicly the encouragement and assistance given us by Mr. C. Russell Mason, Executive Director of the Massachusetts Audubon Society. I am also indebted to Mr. James L. Peters of the Museum of Comparative Zoölogy in Cambridge, Massachusetts. He assisted by correcting this manuscript and by examining the skull of an Ivory-billed Woodpecker which I succeeded in finding. Finally I wish to acknowledge the kindness of the officials of the American Museum of Natural History in New York, including Dr. Ernst Mayr, who first positively identified the Ivory-bill skull.

The entrance hole to the nesting cavity was about thirty feet up in a dead pine stub—low as Ivory-bill nests go. The top of the stub had been blown off, making for a jagged appearance. As we watched this site, we saw the male and female exchange places on the nest—a behavior which showed them to be taking turns at incubation.

The date of nesting is of interest. We were observing the site on April 17, and, of course, had no knowledge of how far incubation had progressed. Bent (1939) gives the nesting time for the American bird as March, April and early May. Occasionally nesting begins in February. In Louisiana the birds nested later than in Florida. Records for Florida show that the young are usually fledged by April. There is a chance that the site we observed may have been used by a pair making a second nesting attempt. There is one bit of evidence that gives a vestige of support to this theory. While examining the vicinity of the nesting site, I came upon the skull of a woodpecker which was later identified as that of an Ivory-bill. It was in good

condition. Later careful examination by Mr. James L. Peters determined that the skull was almost certainly that of an adult. If there had been an unsuccessful first nesting, it follows that the skull might have belonged to a victim of such an attempt. Against the evidence that this was a late nesting, is the unconfirmed information we received that another pair was nesting at that same time in the region. It also might be mentioned that the West Indian Red-bellied Woodpecker, *Centurus superciliaris*, was also nesting during this time.

The nesting site was in a comparatively open area on the western slope of a ridge, about three-fourths of the way up. A small stream flowed in the valley below. The western slope supported a better growth of trees than did the eastern one. Pine was the predominant growth. Dead pines in the vicinity of the nesting stub were from ten to thirteen inches in diameter. The nesting stub, about a foot in diameter, was quite advanced in decay, being split in places and wholly devoid of bark. There were two openings near the top of the stub, one used by the Ivory-bills. The one in use was several inches above the other opening and faced west. The second opening faced south. A remarkable feature of this opening was that it seemed to lead into the main nesting cavity. Looking up into it from the ground I could see daylight which must have filtered through from the main entrance. This opening was smaller and oval in shape, and probably too small to have allowed passage by the Ivory-bills. The main entrance, on the other hand, formed a square, roughly four inches by four inches. (This is clearly shown in photographs in our possession.) Tanner describes all the holes he saw in the Singer Tract as varying from oval through egg-shaped to nearly triangular. While the hole we observed was not a perfect square, it was far more angular than oval in shape. This hole was about thirty feet up, as previously mentioned, and a foot and a half from the top of the stub. Directly in a line below it were two other holes—these quite irregular and two and four feet, respectively, below the main entrance.

On the ground about the nesting site there was a pile of fresh chips. At a distance of twenty to thirty feet from the nesting tree, a dead pine lay on the ground. In the trunk of this tree I discovered a former Ivory-bill nesting site. This was a typical cavity with one entrance. The entrance hole was approximately three by five inches, being rectangular in shape. The inside diameter was nine inches, and the depth of the cavity was one foot. Tanner cites as a shallow nest one of fourteen inches. But he mentions that Audubon once found a cavity with a depth of ten inches. Tanner gives as an average, twenty inches. While the cavity I examined is not nearly this deep,

it must be remembered that the Cuban bird is considerably smaller. The American Ivory-bill averages about twenty inches in length while the Cuban bird (Cory, 1886) is eighteen and one-half inches. The finding of this old nesting cavity so near the new one suggests that the Ivory-bills have nested in this immediate vicinity for a number of years. In fact, this region, as I later discovered, was one of the areas that had been described to us as a nesting site in 1943. It is quite significant that the birds had continued here so long in spite of changing conditions.

For the most part our observations as to habits and behavior follow Tanner's description (1943) of Ivory-bills at the Singer Tract under the heading of 'General Habits and Behavior.' Tanner's description of the way the Ivory-bill clings to trees "with both feet wide apart and forward" and climbs "by springing upward and shifting the foothold near the conclusion of each leap" follow our observations exactly. There is one point that Tanner does not mention, nor have I seen it mentioned elsewhere, and that is the method the Ivory-bill uses to grasp a tree trunk with its toes. Allen (1925) states that it is usual in most woodpeckers for the first and fourth toes to be turned back and the second and third turned forward; this is called a zygodactyl or yoke-toed condition. Allen goes on to say that owls show an intermediate condition, and can turn the fourth toe back at will. From our observations we gathered that the Ivory-bill more nearly resembles the owl in this respect. For whenever we observed Ivory-bills grasping the trunk of a tree, three toes were turned forward and one was turned back. This characteristic method of grasping a tree trunk was one of the first things we noted when we saw the birds. Their long bluish toes, wide-spread and thrust forward, immediately attract attention. Unfortunately none of my photographs (all in color) show this characteristic. But plate 17 in Tanner shows this clearly. This photograph shows the right leg thrust forward with three of the toes widely spread and pointing forward. This is the typical method of grasping which we noted in the Cuban Ivory-bill. I might add that the colored plate, the frontispiece in Tanner's report, shows Ivory-bills grasping a tree trunk in the manner of other woodpeckers. This is true also in Audubon's painting of the American Ivory-bill.

Another dissimilarity to other woodpeckers is that the Ivory-bill does not seem to drum. Tanner reports that he heard no drumming or rolling. But in procuring food, the Ivory-bill taps like any other woodpecker. One other method of procuring food which we saw the birds employ was to knock off slabs of bark by using the bill as a sort

of mallet. This was done only on small pine trees where the birds were evidently seeking the grubs of beetles which lived beneath the bark. Tanner describes this method when he says: "They knock the bark loose with sidewise blows and quick flicks of the bill." Conventional tapping, as we noted it, was done quite leisurely. This was perhaps because most of our observations were made during the heat of the day. I watched the male bird for some twenty minutes perched upon the horizontal limb of a living deciduous tree where he was engaged in tapping upon one particular spot. Usually the taps were given in succession of threes and fours, followed by a quick flick of the bill to clean out the chips. My impression was that he was not using his full force in these blows. The tap was given slowly and deliberately, and the ensuing noise scarcely equaled in volume the work of the Downy Woodpecker. The only noisy tapping we heard was three or four taps given at slow intervals when the birds appeared to be starting work upon a new tree. Double raps, described by Tanner as given frequently when the birds are "disturbed by the presence of persons or when one of the pair is absent," were occasionally heard.

The only other prolonged activity in which either of the birds engaged while near the nesting site was preening and scratching. They spent so much time at this that I considered it unusual. Tanner, however, writes that "they often preen and scratch themselves, especially during the times of the day they are not actively feeding."

An occasional activity appeared to be defense of the nesting site. An instance of this was when a Sparrow Hawk (a pair was nesting in the vicinity) swooped down close to the entrance of the nesting cavity. At once the male bird, leaving his idle tapping, was off in hot pursuit. His flight was direct and rapid as he gave chase. My recollection of the flight of the Ivory-bill is that it was never undulating, but always in a straight line.

As to the Ivory-bill's voice, I have nothing to report from my notes. Mr. Crompton, however, took pains to record the exact interpretation of the calls he heard. He describes one note by the female only as a *hump* repeated slowly at intervals. The characteristic note, given by both sexes, he describes as a *hant* repeated six times.

No attempt was made to time the periods each bird stayed on the nest. Only a few general observations are available on the behavior of the birds at the nesting tree. When we first arrived in the vicinity, the birds appeared somewhat agitated. At no time, however, would I say that they were shy. The agitation manifested itself by considerable vocal activity and by frequent changes of place on the nest. But as the birds became used to our presence, they seemed positively

lethargic as they loitered in near-by trees. Later in the afternoon the birds disappeared—one evidently remaining on the nest while the other went on an excursion in search of food. Before we left the region, at least an hour elapsed without either of the birds showing itself. On all occasions when one of the birds came to relieve its mate, there was quite a flurry of activity. The relieving bird would nervously hop about at the entrance to the nesting cavity. The bird leaving the cavity, on its part, showed no hesitation, but would pop out unexpectedly and make for another tree.

My notes on the plumage of the Ivory-bill deal chiefly with the crest. The birds seem to have a certain amount of control as to the erection and lowering of the crest. But, strangely enough, the crest seemed to be in a state of complete disarray most of the time. This was due to the wind, which, although not strong, was enough to give the crest a disorderly and even grotesque look. The female, No. 2 in Audubon's plate on the Ivory-bill, has a tousled crest. This representation of the Ivory-bill is truly life-like. Even when the crest of the female was orderly, we noted that it never came to a sharp point, but rather to a blunt conical point. The male did have a relatively pointed crest when it was in order.

When one considers the future of the Cuban Ivory-bill, one of the most significant facts is that the pair we observed, as well as other pairs of which we had reports as having nested in the region at one time, nested in cut-over pine forest. Originally their preferred habitat had, undoubtedly, been virgin stands of pine forest. But as this was cut, some of the birds had managed to adapt themselves to the scrub growth that remained, finding their food supply in dead and dying trees. The pair we studied lived in a region that had been logged, as far as I could determine, seven years ago. And all evidence pointed to the fact that they had been there for five seasons at least. In connection with the Cuban Ivory-bill's apparent preference for pine woods, it is interesting to note that the largest member of the genus, the Imperial Woodpecker, *Campephilus imperialis* (Gould) of México, is found in pine forests. Tanner states that it inhabits the pine forests of the Sierras of northwestern México. The American Ivory-billed Woodpecker, however, does not show this preference. Tanner relates that its habitat outside of Florida consists of bottomland forests where sweet gum and oaks predominate. In Florida its preferred habitat is cypress swamps and swampy hammocks. Yet in Florida there have been cases where the Ivory-bill frequented pine woods. Allen and Kellogg (1937) give an instance of this. Writing of birds that nested in a cypress swamp, they state that "the birds apparently

did most of their feeding in the dead pines at the edge of the swamp, scaling off the bark of those small and medium-sized pines that had been killed by fire . . ."

During the first several days of our stay in the region where the Ivory-bills had been reported, Mr. Crompton and I spent our time searching through the most likely areas of the remaining deciduous forest. These areas had all been logged to some extent, but the growth was very luxuriant with huge trees towering above the forest floor. In such forests we saw no sign whatsoever of the Ivory-bill. Yet other types of woodpeckers were much more abundant here than in the cut-over pine forest. In the woods adjacent to the Ivory-bill nesting site, for instance, we found woodpeckers quite scarce. During the entire day we spent in these woods, we saw, at the most, two West Indian Red-bellied Woodpeckers, *Centurus superciliaris*, and one Cuban Green Woodpecker, *Xiphidiopicus percussus*. What accounts we had of the history of the Ivory-bill in this region showed that they had frequented pine forest. While we were in the region we heard of one other active nesting site. This too was in pine forest, and approximately three miles from the site we observed. Due to circumstances beyond our control we were unable to substantiate the existence of this site.

As Tanner has pointed out, the chief cause for the disappearance of the American Ivory-bill was the destruction of virgin forest. This meant the loss of a super-abundance of dead wood on which the Ivory-bill depends for its food supply. The larvae of cerambycid and other beetles which constitute the principal source of food for the Ivory-bill is found abundantly in dead and dying trees. But from observations in Cuba it would seem that the Ivory-bill can find such a food supply more advantageously in cut-over pine forests where millions of trees were already dead or were in the process of being killed by fire and, presumably, by the attacks of insects. The question here, however, is how much longer will a forest, deteriorating as this one is, support the Ivory-billed Woodpecker. Continued fire and cutting, added to the effects of erosion, will in time make this region a virtual waste-land. This, of course, will seal the doom of the Ivory-bill even if the bird is spared by humans. On the other hand, there is the possibility that the lumbering interests will move out and that the region will be given a chance to recuperate. Even if a certain amount of fire continues to burn certain areas, this is not necessarily unfavorable as the Ivory-bills may depend upon a continued supply of dead trees.

But whatever the outcome in regard to the forces at work upon the

environment, the few remaining Ivory-bills are in constant danger of being exterminated by humans. For example, early in 1948 a dead bird was seen nailed to the side of a native hut. We found that it was a common practice for the people in this region to take young woodpeckers out of their nest and use them for food. The common woodpeckers of the region were the usual victims, but there is no reason to doubt that the natives would not hesitate about robbing an Ivory-bill nest should they come upon one. With the region opening up for settlement, it can hardly be hoped that the Ivory-bills will escape observation.

We asked a very intelligent boy, who acted as our guide, what measures in his opinion would safeguard the Ivory-bill. He emphatically stated that if a warden were to be sent in to patrol the region, the people would respect his presence and leave the Ivory-bills alone. This simple expedient would seem to be well worth trying, particularly as it might mean the difference between the survival of a species and its total extinction.

Whatever the future holds for the Cuban Ivory-bill, one thing seems to be certain, and this is that on the long path of evolution from the origin of a species to its total oblivion, the Ivory-bill in Cuba has a slight edge on the American bird as the two go down to extinction—this, in face of the fact that Cuba was settled a hundred years earlier than our country and has suffered more from deforestation as the country was cleared for grazing and the sugar industry. The bird has not survived in Cuba, however, due to any innate gentleness on the part of Cubans toward birds. Just as in our country, the Ivory-bill was killed for every conceivable reason—sport, food, trophies, curiosity. Not as many were killed by professional collectors, simply because the birds vanished so quickly from all accessible parts of the country. The fact that a few roadless wilderness areas have remained up until the present time as well as the apparent ability of the birds to meet changing conditions seem to have allowed a few to survive. If present trends continue these few birds will quickly disappear.

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Moose Hill Sanctuary
Sharon, Massachusetts

GEOGRAPHIC VARIATION IN *EMPIDONAX TRAILLII*

BY ALLAN R. PHILLIPS

OF ALL the birds of North America, the Alder Flycatcher, with its willow-inhabiting races in the west, is perhaps as difficult as any to the taxonomist. Except for the lack of pronounced sexual differences, these birds present nearly every possible difficulty. Indeed, the very similarity of the sexes poses a problem; a large female of one race may be confused with a small male of another, leading to doubt as to whether the bird was breeding or on migration when taken. The species migrates both very late in spring and early in fall; only from June 25 to July 20 may the birds be presumed to be on their breeding grounds; and at this time most of them are in poor plumage.[1] In cases of this sort, the inadequacy of the usual museum label (which gives no data on sexual condition or on plant association) becomes painfully apparent. Besides these difficulties, size varies rather independently of color; immatures differ from adults; adults migrate before their post-nuptial molt; and it is no easy matter even to distinguish this from other species of *Empidonax*. Perhaps the worst features of all are the manner of intergrading, by wide individual variation in intermediate areas, and certain peculiarities in the distribution of the races, which does not always coincide with the distribution of races of most other species (which we think of as 'natural' ranges). This last situation might well be suspected from the proximity of the type localities of *brewsteri* and *adastus*, both of which lie in the western Great Basin region.

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[1] Even as far south as Costa Rica (Agua Caliente, 4500 feet alt.), on May 24, 1920, Austin Paul Smith wrote on the label of a specimen of *brewsteri:* "No sign of breeding, and species rather common in old pastures—perhaps migrants!" But the extreme limits of the birds' stay in Central America are not clear; the June 4 specimen of *brewsteri* from Hacienda California, Guatemala, had sustained an injury to the right wing.

An attempt to determine which races occur in Arizona proved to require a review of the species. This review is based primarily on the specimens in the United States National Museum (including the Fish and Wildlife Service collection), American Museum of Natural History, Cornell University, University of Arizona (including the Arizona State Museum), University of Utah, Museum of Northern Arizona, and the collections of Lyndon L. Hargrave, Gale Monson, and the writer. Some birds were also examined from the collections of the Academy of Natural Sciences of Philadelphia, Cleveland Museum of Natural History, University of Michigan Museum of Zoology, University of California Museum of Vertebrate Zoology, and the Dickey collections, University of California at Los Angeles. I am greatly indebted to the authorities in charge of these collections.

From these studies, pursued intermittently over a period of six years, it appears that five races may be recognized, as follows:

Empidonax traillii traillii (Audubon)

Muscicapa Traillii Audubon, Birds Amer. (folio), 1: plate 45, 1828 (Prairie lands of the [lower] Arkansas River).

Empidonax ridgwayi Sclater, Proc. Zool. Soc. London, 1887: 50 ("Bogota," Colombia). *See* van Rossem, 1934: 350.

Empidonax traillii alnorum Brewster, Auk, 12: 161, 1895 (Upton, Maine).

SUBSPECIFIC CHARACTERS: Entire head, neck and upper parts greenish and relatively uniform; wing-bars prominent, pale yellowish; under parts rather uniform, the grayish chest-band not conspicuously darker than throat and belly; wing rather pointed, with tenth (outer) primary usually equal to or longer than fifth.

MEASUREMENTS: In most populations, wing (chord) of males, 68.3 to 72.9 mm. (average 71.0); of females, 65.3 to 68.5 and (one specimen) 69.0 (average 66.95). Tail, males, 55.8 to 61.1 (58.6); females, 54.1 to 57.8 and 58.9 (55.8).

Occasional eastern colonies are somewhat larger (males, wing, 72.0 to 74.4 and even 75.2; tail, 58.3 to 61.6) and more brownish on the back and rump; some of them, at least, also differ in rather darker coloration, particularly on the crown and nape. But no broad geographic segregation of the two types is evident.

RANGE: Breeds across southern Canada and in the northeastern and central United States, west to British Columbia (Lac La Hache; Hazelton), Montana (Java, Blackfoot Agency, Fort Keogh, and northeast of Albion), and probably eastern Wyoming (Douglas, June 3 and July 29). Migrates through central United States (west to trans-

Pecos Texas) and Central America. Winters widely in South America, north rarely to Costa Rica (Dota, "Feb. 29, 1866") and even Nicaragua (San Carlos, Feb. 25, 1892).[1] Guatemala migrations are in May and from August (26, Panajachel) to September (11, Progreso).

REMARKS: From Audubon's account of the date and their notes and actions, the cotypes were evidently on their breeding grounds. This is fortunate, as the application of the name *traillii* might otherwise be difficult; the lectotype (U. S. Nat. Mus. no. 1865) is a bird of maximum size, measuring: wing, 73.6; tail, 58.2 mm. Measurements of the type (not sexed) of *ridgwayi*, furnished through the kindness of A. J. van Rossem, are: wing, 70 mm.; tail, 57.5; tarsus, 16.0; and exposed ("total") culmen, 11.8; these are quite normal for a male of this widespread race.

Agreeing with Anderson (1934) that English names for subspecies are undesirable, I do not propose any. Of the English names already used for one race or another of this species, Alder Flycatcher is the least objectionable; yet it is appropriate for only a part of the range, even of the race now so designated! Willows, and even rosaceous shrubs, are evidently more widely occupied by the species as a whole. What is common to, and diagnostic of, the entire species is a habitat of low, dense brush. A good specific name might be "Thicket Flycatcher."

Empidonax traillii alascensis, subsp. nov.

TYPE: United States National Museum no. 187,242, Fish and Wildlife Service collection; adult male; Charlie Creek, Yukon River, Alaska, June 21, 1903; collected by W. H. Osgood (original no. 774).

SUBSPECIFIC CHARACTERS: Very similar to *E. t. traillii*, but wing longer and tail averaging longer. The more brownish-backed specimens differ from the largest, brownish *traillii* in their paler heads with the green feather-edgings paler, grayer, and perhaps broader; their backs, too, are paler, but color differences are minute.

MEASUREMENTS: Wing, males, 71.5 (one specimen from Mackenzie) and 73.3 to 77.4 mm. (average 75.1); females, 67.8 to 71.1 (average 69.5). Tail, males, 57.6 (same specimen) and 58.6 to 64.1 (61.4); females, 55.2 to 58.8 (57.1). Females seen only from Mackenzie and Yukon, none from northern Alaska.

RANGE: Breeds in northern Alaska (Nulato and eastern Yukon River), Yukon (Ft. Selkirk), and northwestern Mackenzie (Forts Norman, McPherson, and Good Hope). Migrates through Alberta (Edmonton, May 30, 1896), Montana (Fort Keogh and Terry, June

[1] Specimens recorded from Salvador in winter were not examined by me.

2 to 6; Summit, June 19), Wyoming (Douglas, May 29 and Aug. 10), North Dakota (Lisbon, May 28; Pembina, June 3), South Dakota (Pierre and Smithville, May 30 to 31), Colorado (Wray, May 21; northeast of Avalo, June 7), Oklahoma (Arnett, May 27), and Texas (Tivoli, Aug. 16; near Santa Rosa, Cameron Co., Sept. 20), and east to Louisiana (New Orleans, Sept. 9 and 16) and Mississippi (Bay St. Louis, Deer Island, and Gulfport, Sept. 6 to 14). Several specimens sexed as females indicate, if no mistake was made, that it migrates through Central America to Colombia (Honda, Magdalena River, Feb. 8, 1913). Casual in southern Baja California (San Bernardo Mt., May 15, 1911).

REMARKS: Birds from the Athabaska Delta, Great Slave Lake, Slave River at Smith Landing, and Mackenzie River at Nahanni River Mts. are intermediate toward *E. t. traillii*. A single female (wing 68 mm.) from the Kenai Mts., Alaska, may also prove to be an intermediate; no other specimens from southern Alaska were examined.

In size this race resembles *E. virescens*. The latter, however, has a broader and deeper bill, paler and more greenish head (which is less contrasted with the back), a more pointed wing with the tenth primary usually about equal to the sixth instead of decidedly shorter, and often brighter wing-bars; the juvenal plumage, too, is quite different.

Empidonax traillii adastus Oberholser

Empidonax traillii adastus Oberholser, Sci. Publ. Cleveland Mus. Nat. Hist., 4: 3, 1932 (Hart Mt., 20 miles northeast of Adel, Oregon).

SUBSPECIFIC CHARACTERS: Head (especially sides of neck) grayish, more contrasted with the back than in *traillii* or *alascensis;* back duller and more grayish green, rarely with a brownish cast; wing-bars darker and duller, less prominent; grayish chest-band darker and more pronounced; wing more rounded, the tenth (outer) primary usually shorter than the fifth; wing-length as in *traillii*, but tail somewhat longer.

MEASUREMENTS: Practically identical with those of *extimus* (see below), with bill and tail averaging very slightly smaller, but not sufficiently so to be of any use in identifying individual specimens. Males, wing, 68.1 to 73.7 mm. (averaging 71.0); tail, 58 to 63.2 (60.5).

RANGE: Breeds in the northern Great Basin region from southern British Columbia (Ashcroft, Okanagan) south to northern Modoc County, California (Sugar Hill, Goose Lake near Davis Creek), northern Nevada (Glenbrook, May 30), probably northern Utah (Clear Creek, Aug. 9), and along the east base of the Rocky Mts. south to southern Colorado (Pueblo, Colorado Springs) and possibly

northwestern Oklahoma (Kenton, May 20 to June 4). Migrates principally east of the Rocky Mts.; common in Brewster County, Texas, and ranges east to San Angelo (Aug. 4) and Ingram (May 21) and west rarely to eastern Arizona (northern Navajo County, as reported by Woodbury and Russell, 1945: 75; near Patagonia, Aug. 8, 1940). Winters from Michoacan (La Salada, March 18), Guatemala (Hacienda California, Nov. 1), probably Nicaragua (Tipitapa, Dept. Managua, Apr. 27 and 29), and Costa Rica to Colombia (Calamar, Magdalena River).

REMARKS: A large part of southwestern Oregon is inhabited by intermediates between *brewsteri* and *adastus*. These birds vary individually; birds much like *adastus* occur west at least to Salem, while darker and browner birds approaching *brewsteri* occur east to Fort Klamath and even to the head of Drew's Creek, Lake County, not far from the type locality of *adastus*. This area of intergradation extends south into California and north through a good part of western Oregon.

Empidonax traillii brewsteri Oberholser

Empidonax traillii brewsteri Oberholser, Ohio Jour. Sci., 18: 93, 1918 (Cloverdale, Nye County, Nevada).

Empidonax traillii zopholegus Oberholser, Proc. Biol. Soc. Wash., 60: 77, 1947 (South Vancouver, British Columbia).

SUBSPECIFIC CHARACTERS: Similar to *E. t. adastus*, but adults (especially males) with back and head darker and more suffused with brownish. Females average paler than males, and immatures do not appear to be safely separable from *adastus*.

MEASUREMENTS: Birds from east of the Sierra Nevada are of the same size as *adastus*. Those from the Pacific Coast region are smaller: males, wing usually 66 to 69.6 mm. (averaging 68.1); tail, 56.4 to 60.2 (58.0); tarsus, 15.7 to 16.7 (16.1); exposed culmen, 11.2 to 12.6 (11.9); extreme length in flesh, 148 to 151 (149.2); weight (one male, June), 11.6 grams; females, wing, 60.7 (one specimen from San Gabriel, Calif.) and 61.8 to 66 (64.2); tail, 52.3 (same specimen) and 54 to 58.4 (55.8); tarsus, 15.2 to 16.4 (15.8); culmen, 10.5 to 12.0 (11.3); length, 138 to 149 (144.9); weight (one female, August, fat), 12.3 grams.

RANGE: Breeds along the Pacific Coast from southwestern British Columbia to southwestern California (except, as noted above, in southern and central Oregon); also in a narrow east-to-west belt in the interior, from northern Nevada (Mountain City) and northern Utah (Great Salt Lake region) south to Owens Valley, California, and apparently northeastern Arizona (Tuba City), and east probably to central southern Colorado (Salida, May 23). Migrates from eastern

New Mexico (Santa Rosa, May 26), western Texas (Tascosa, May 21 and June 6; Brewster County, May 14 to 24 and June 17), and Tamaulipas (Jaumave, June 2) west to southeastern California (Brawley) and northernmost Baja California (Mt. Mayor, Colorado Delta, May 24; Nachoguero Valley at U. S. border, June 1),[1] but apparently not on the peninsula farther south. Winters from the Pacific Coast of Guatemala (San José) to eastern Panamá (Chepigana).

REMARKS: Supposed specimens of *brewsteri* from east of the range outlined above prove to be erroneously determined immature or faded specimens, mostly of *E. t. traillii;* such birds are from eastern Nebraska, central Oklahoma, and northern, central, and eastern Texas.

Birds from east of the Sierra Nevada appear darkest on the back, as well as slightly larger than coastal birds. Badly worn and faded birds from Tuba City, Arizona, and northward seem to be of this type. Those from northwestern Oregon northward incline very slightly toward *E. t. traillii* in averaging a trifle more olivaceous above, but are decidedly closest to *brewsteri* and are identical in coloration with birds from various scattered localities where *brewsteri* intergrades with other races. All these color differences are trivial.

In size, it is perfectly true that coastal birds are smaller, but overlapping is great when large series are compared. The smallest male *brewsteri* from east of the Sierra Nevada measure: wing, 68.3 to 69.0 mm.; tail, 58.5 to 59.4. Conversely, some coastal birds are large: males, wing, 69.6 to 70.2 (and even 71.4 and 72.3); tail, 58.4 to 61.2 (and even 62.3); females, wing, 66.0 to 66.4; tail, 56.7 to 57.6 (one female 59.1). Thus the extremes of one population are about equal to the average of the other. This means, of course, that somewhat less than half of the birds can be identified by size alone, and nomenclatural recognition of the difference is impractical.

In every way in which *adastus* differs from *brewsteri*, coastal birds agree with the latter. Furthermore, nobody has ever claimed that the coastal birds were *adastus*. It seems clear, therefore, that *adastus* is not the closest relative of the coastal birds; yet it is the only race with which "*zopholegus*" is compared.

Empidonax traillii extimus, subsp. nov.

TYPE: Collection of Allan R. Phillips, no. 707; breeding male; Feldman, lower San Pedro River, Arizona, May 30, 1940; collected by Gale Monson (original no. 89).

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[1] Other records in the literature for extreme northern Baja California probably also pertain to this race.

SUBSPECIFIC CHARACTERS: The palest race of *E. traillii*. Adults most closely resemble *adastus*, but are even paler above (decidedly paler and less brownish than *brewsteri*); this is most noticeable on the head. Cheeks paler than in *adastus*, and more gradually merging into the more grayish areas below and behind; chest-band less pronounced, and belly and crissum paler yellow. Crown distinctly paler, and succeeded by a more distinct gray collar. Rectrices less blackish. The wing-bars (especially the posterior one) tend to be paler, the edgings of the tertials broader and paler, and the outer web of outer rectrix slightly paler, but these are less constant differences. Size (particularly of bill and tail) is rather large, but not diagnostic. The few fresh-plumaged females studied average more gray and brown (less olive) than males, but unlike *brewsteri* are not noticeably paler than males. Some rather strikingly pale immatures occur in the range of this race, but as yet the range of variation in locally raised immatures is uncertain, and the identification of these pale immatures is by inference.

MEASUREMENTS: Males, wing, 68.9 to 73.0 mm. (averaging 70.7); tail, 59.3 to 64.7 (61.9); tarsus, 15.2 to 16.6 (15.9); exposed culmen, 11.4 to 13.0 (12.2); extreme length in flesh, 155 to 158.5 and even (one specimen) "167"; weight (May), 12.1 to 13.2 and (one specimen) 14.0 grams. Females, wing, 64.5 to 69.5 (66.4); tail, 55.2 to 60.6 (57.7); tarsus, 14.4 to 16.4 (15.6); culmen, 10.9 to 12.4 (11.8); length 146 to 152 (148.4); weight (Sept. 1 and late July), 11.1 and 11.95 grams, probably somewhat heavier in May.

The above, like all measurements given in this paper, are for adults. The few data available suggest that immatures have wings about 1.5 mm. shorter than adults and tails 2 to 3 mm. shorter.

RANGE: Breeds in willows and other swamp bushes along the main rivers and streams of southern and western Arizona, from the Lower Sonoran Zone up (very locally) into the Transition Zone. Ranges north and east to southern Nevada (Indian Springs, Clark County), southwestern Utah (St. George and Springdale), central and central-eastern Arizona (Camp Verde and Alpine), and, in surprisingly atypical form, to southwestern New Mexico (near Redrock); also probably on the Rio Grande in western Texas (Fort Hancock, June 18). Breeds, or formerly bred, south to Yuma, Tucson, and Charleston (upper San Pedro River), Arizona, and probably to the Arizona-Sonora border at Nogales ("June, 1855") and San Bernardino Ranch (several, mostly immatures, late August). Winters from Salvador (Río San Miguel, 13° 25′ N., Dept. San Miguel; also Lake Olomega, Aug. 14 to Sept. 3) and Nicaragua (Greytown) to Costa Rica (Bebedero,

Sept. 13) and rarely Colombia (Turbaco, Chocó, Aug. 15, 1911; Honda, Magdalena River, Feb. 7, 1913).

REMARKS: Breeding birds from northeastern Arizona, southwestern Colorado, and much of New Mexico (particularly from Springerville, Arizona, east to the Rio Grande) show great individual variation, and are thus intermediate between *extimus* and *brewsteri*. A male in peculiar, retarded plumage from the Gallinas River at Las Vegas, New Mexico, May 23, seems to be typical *extimus*. Further collecting may extend the range of *extimus* somewhat to the northeast.

This is not the common race in general collections of southern Arizona birds; even among June birds, somewhat more than half the specimens examined proved to be transient *brewsteri*. *Extimus* is now greatly reduced in numbers, and no breeding colonies are known to survive south of Feldman. Since the territory is generally unfavorable, colonies are few and far between, especially in recent years, and the total population is relatively small. This is doubtless the reason that few migrants, in extensive series examined, have been identified as *extimus*.

The pale wing-bars, under parts, and outer webs of rectrices of extreme individuals of this race at one time led me to think they might be hybrids with *E. t. traillii* or other species of *Empidonax*.

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THE NESTING OF *CHAETURA ANDREI MERIDIONALIS*

BY HELMUT SICK

Plate 14

ON the middle Rio das Mortes (15° S., 52° 15′ W. Greenwich), Mato Grosso, Brazil, I frequently observed a swift that inhabited principally the extensive groves of "buritî" palms. On October 15, 1946, I located two nests of the species. One was torn from its base when I attempted to make it accessible for closer investigation; the other one was studied in detail. Later on I discovered a third nest.

On November 2, 1946, an adult bird was shot on the second nest mentioned. I determined this specimen tentatively as *Chaetura andrei meridionalis* Hellmayr and my supposition has now been confirmed in the collection of the Department of Zoology, São Paulo. The locality of the present studies was the same as that of the previous studies on *Reinarda squamata* (Sick, 1947b).

1. THE NEST IN LITERATURE

The question concerning the structure of the nest of this *Chaetura* has been mentioned several times in publications, but it has not been satisfactorily answered. What Wied (1830) writes under *Chaetura pelasgius* relates apparently to the North American *Chaetura pelagica*. Euler (1867) refers definitely to "*Acanthylis oxyura*" (= *Chaetura andrei meridionalis*), describing a big, closed, bag-like nest of felt with the entrance from below. This account was confirmed by Goeldi in his own observations in 1894 and 1898 and was again repeated by Euler (1900) and Ihering (1900). Hartert (1892) cites the publication of Euler by title only; one may therefore draw the conclusion that he did not have full confidence in the observation. Ridgway (1911) openly doubts the Goeldi-Euler observations.

It never appeared very probable that a *Chaetura* would build a nest resembling that of *Panyptila;* the authors of the observations, however, were serious scientists and confirmed each other's observations. Therefore, in my publication on the nest of *Panyptila cayennensis*, I proposed the theory that *Chaetura andrei meridionalis* perhaps might occasionally use the ready-built nests of *Panyptila* and thus might be observed on the felt nests of this species.

2. DESCRIPTION OF THE NESTS FOUND ON THE RIO DAS MORTES

I had the pleasant satisfaction to encounter the debated swift breeding in central Brazil. The nest is an open cup similar in construction to that of the Chimney Swift (*Chaetura pelagica*). In the

National Museum, Rio de Janeiro, I compared it with a nest of *Chaetura cinereiventris*, collected in Teresópolis (State of Rio de Janeiro) which shows the same type of construction (*vide* Miranda Ribeiro, 1929).

Nest 1 (A. 121, F. B. C.); *see* Plate 14. Constructed almost entirely of one type of dry leaf stalks having a length of 5 cm. The natural bend of the stalks is seldom embodied into the shape of the nest. The arrangement of the layers is crude but fixed; the ends of the stalks frequently project far outside.

The stalks are probably those of a Bombacaceous tree. When the foliage begins to fall, first the small leaves drop off and then the stalks. One may assume that the bird, while passing by in flight, picks off the leafless stalks that are still attached to the tree. Should the stalk still have leaves attached to it, they certainly become detached during transport. The observation that the stalks found in the nest sometimes include a piece of branch may lead one to assume that they are torn from the branches in the manner that *Chaetura pelagica* uses to tear similar material with its feet.

The stalks are blackened, and must have come, therefore, from a tree that was reached by fire and thus defoliated. Such burned material would furnish the preferred supply for the bird at times when Bombacaceae do not shed their foliage seasonally. The wild Chavantes Indians inhabiting the Rio das Mortes region frequently fire the savanna and one finds partially burnt vegetation everywhere in that otherwise uninhabited territory.

The structure of the nest lacks density and is therefore transparent. Adhesive saliva is seen as a thick, yellow, glue-like mass on the place of the attachment of the nest and to a lesser degree on its front side. The nest does not have a rear wall, which is represented by the side of the tree; its suspension is effected by attachment at the circumference (compare *Panyptila cayennensis* [Sick, 1947a]).

The nest was found in a hollow, 6-meter-high trunk of a "buritĺ" palm (*Mauritia* sp.) which had lost its crown. The opening at the top formed the only entrance into the trunk. The nest was attached to the inner side of the trunk, about one meter above the ground in the darkness. The trunk had to be broken open on the side in order to gain access to the nest.

Measurements (without the protruding stalks): left to right, 9.5 cm.; site of attachment to the front, 5 cm.; depth of nest trough, almost 3 cm.

Nest 2 (A. 123, F. B. C.). Structure not as uniform as that of nest 1; only a few of the above described leaf stalks present; mostly

NEST OF *Chaetura andrei meridionalis;* RIO DAS MORTES, MATO GROSSO, BRAZIL. THE HIGHLIGHTED SPOTS AT THE LEFT ARE FROM THE HARDENED MUCILAGINOUS SALIVA USED AS AN ADHESIVE.

twigs of varying thickness. Measurements: left to right, 8.5 cm.; rear to front, 3.5 cm. The nest appears as if pressed flat, probably adapted to the non-vertical site of attachment. Depth of the nest-trough about 3 cm. Nest placed in a hollow, 7-meter-high "buritĭ" trunk without a crown, but closed on the top. There are two openings in the sides of the trunk, one about the size of a hand, 5 m. above the ground, and another one smaller and nearer the ground. This nest was found 3 m. above the ground inside the trunk.

Nest 3 (A. 47, F. B. C.). Material of construction the same as in nest 2. Beside twigs, some fibers of dry "buritĭ" leaves of which also one was found in nest 1. Measurements: left to right, 7.5 cm.; rear to front, 4.5 cm.; depth of trough, 2.5 cm. Placed in a hollow "buritĭ" trunk, open at the top and about 6 m. high. Nest inside the trunk about 2.5 m. above ground.

3. Eggs

All the collected nests contained eggs.

Nest 1 contained five eggs on October 15, 1946. On October 18, only four were left which were collected November 2 (A. 122, F. B. C.). Measurements: 13.1 x 19.1; 13.0 x 18.0; 13.4 x 18.2; 13.2 x 17.5 mm.

Nest 2 was found in a fallen trunk and the eggs had rolled out. Of four, only two could be measured (A. 124, F. B. C.): 13.2 x 18.7; 13.4 x 18.8 mm.

Nest 3 had five eggs, of which two were destroyed during collection. Measurements of the others (A. 46, F. B. C.): 13.0 x 19.0; 13.1 x 18.7; 13.1 x 19.0 mm.

The average measurments of the nine eggs are 13.2 x 18.6 mm. The differences in size of the eggs encountered in nest 1 are surprisingly great. The relatively high number of eggs in each nest (four to five) is found also among other Brazilian swifts. Holt (1928) encountered five young birds in the nest of *Cypseloides fumigatus* as did Miranda Ribeiro (1929) in the nest of *Chaetura cinereiventris*.

4. Further Biological Notes

Breeding in hollow trees has already been observed for other species of *Chaetura* such as *C. pelagica* and *C. vauxi*. It is interesting that, although the sleeping place of *Chaetura andrei meridionalis* was described a hundred years ago, the nest remained unknown until now. Nosada (according to Azara, from Burmeister, 1856) found a flock of forty birds in a hollow tree. I noted for *Reinarda squamata* that the sleeping place can be indicative of the probable breeding place.

It may be added that Wied (1821; 1830), under his "*Cypselus pelasgius*" mentioned large flocks of birds which settled for sleep on the "mangue" bushes of the coast of middle Brazil. Wied, however, only suspected that he was dealing with this species. According to our present knowledge of the anatomy of swifts, it is not very probable that a *Chaetura* will perch on branches.

The state of development of the eggs in the three nests was very similar and points to a simultaneous start of breeding. October 15, 1946, two sets of fresh eggs. The condition was directly determined for set no. A. 46; and for set A. 122, which was found (but not collected) on the same day, it was concluded from the size of the embryos on November 2, *i. e.*, 19 days later. Set A. 124 showed the same size of embryos on November 2 that A. 122 exhibited. According to these dates the breeding period of the *Chaetura* corresponds with the end of the dry season to the beginning of the rainy period. A brood of *Reinarda squamata*, observed in the same region, was seen two weeks earlier.

Since I failed to capture or shoot a swift while it was leaving the trunk, I was forced to shoot the bird sitting on nest 1 (A. 120, ♀). I left the nest and also the eggs, not damaged by the shot, untouched during the same afternoon and the following evening in order to gain some knowledge about the second adult bird. Shortly after midnight I approached the location carefully. Neither at the nest nor in proximity to it in the inner part of the tree (which had been made accessible and could be illuminated) could a swift be seen. Upon knocking on the trunk, a slight scratching was heard from above, a noise I had heard on other occasions when swifts left "buritf" trunks. Though I failed to see the bird, little doubt remains that it was the male belonging to nest 1 which had slept higher up in the trunk.

This may be indirect proof that the male does not take part in incubation and does not take over the duties of substituting for the missing female. I may repeat that with *Reinarda* I found the female on the eggs at night, while the male slept clinging below the nest.

Chaetura andrei meridionalis is found in many parts of Brazil. Its flight silhouette and voice have been known to me from the states of Rio de Janeiro and Espirito Santo. In contrast to the long-tailed and on the whole more slender *Reinarda*, *Chaetura* seems to consist almost completely of wings. Its call is a *tip-tip-tip* in series, often carried over into a song-like *dlui-dlui-did*.

As enemies of this *Chaetura* there can be considered only those animals which may capture the bird on the nest, probably the same which endanger eggs and young birds in the nest. It may be assumed

that lizards go after the bird. They are very common in the region and prefer to stay on the outside of the smooth, hot palm trunks; they may perhaps lie in wait for the bird leaving or arriving at the tree. In dead palm trees certainly loss of eggs and young birds is not infrequent when the decayed tree falls down, such as was observed with nest 2.

SUMMARY

Description of the nest of *Chaetura andrei meridionalis*, three of which were found on the Rio das Mortes, Mato Grosso, Brazil. The nest is constructed in the hollow trunks of "buritî" palms. It is an open cup, roughly glued with dry twigs, similar in construction to the already known nests of other *Chaetura* species. Description of the eggs. Two sets of eggs with five and one with four eggs were found. Notes are given about breeding, possible enemies, flight silhouette, and voice.

I take pleasure in expressing my gratitude to Minister João Alberto, founder of the Fundação Brasil Central, and Dr. Manoel J. Ferreira, its present president, who made my studies on the Rio das Mortes possible. Thanks are due to Da. Heloisa Alberto Torres, director of the National Museum of Rio de Janeiro, and Dr. Olivério Pinto, director of the Department of Zoology São Paulo, who facilitated my studies in their institutes. Dr. Kuhlmann and Dr. A. C. Brade of the Botanical Garden, Rio de Janeiro, kindly determined the material used in the construction of nest 1, described in the text.

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THE BONY PALATE OF BIRDS. PART I THE PALAEOGNATHAE

BY SAM MCDOWELL

THIS is the first in a series of papers in which the author intends to describe the osteology of the known birds with the end in mind of throwing more light on their higher systematics. I have chosen as my first topic the bony palate because of the stress laid upon this part of the avian skeleton from Cornay to the present in the classification of birds.

ACKNOWLEDGMENTS

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CLASSIFICATION OF THE PALAEOGNATHAE

The first zoologist to distinguish the large flightless birds from the remainder of the Aves was Merrem, who characterized a special group, Ratitae, on the basis of a keelless sternum, a large number of lumbar vertebrae, and parallel iliac bones. This group included *Struthio*, *Dromaeus*, *Casuarius*, and *Rhea; Apteryx* was apparently not classified, and the tinamous were placed in the contrasting group, Carinatae, characterized by keeled sternum, fewer lumbars, and divergent ilia.

Huxley's classification was essentially similar. *Rhea*, *Struthio*, *Casuarius* and *Dromaeus*, and *Apteryx* were included in the Superorder Ratitae, and the tinamous were placed in the Carinatae, though considered very near the ratites on the basis of the palatal characters and placed at the bottom of the Carinate list. (Huxley, 1867).

The work of Parker, Newton, and others, particularly Andrews and Milne-Edwards, did not change this classification except by including the extinct families Dinornithidae and Aepyornithidae in the Ratitae, these families apparently unknown to Huxley.

Garrod and Forbes regarded the ratites as a natural group, but placed them in the same group as the gallinaceous birds, rather than as a separate superorder.

Max Fürbringer (1888), however, argued that the ratites were a polyphyletic group. The ostriches (*Struthio*) he placed in one 'order' (Fürbringer's orders in reality correspond to superorders; what are generally termed orders were called by Fürbringer 'gens'), the Struthiornithes, *Rhea* in an 'order' Rheornithes, *Casuarius* and *Dromaeus* in an 'order' Hippalectryornithes, and both the Apterygidae and Tinamidae in an 'order' Alectorornithes with the gallinaceous birds. Fürbringer based his conclusions on a detailed study of the muscular, nervous, and skeletal systems of the trunk and limbs, as well as a study of the fossil record.

Dissenters, however, particularly Gadow (1891), attempted to refute Fürbringer and reassert the naturalness of the ratite group on the basis of the similarity of the bony palate among the ratites. Gadow also employed certain visceral characters. He placed *Struthio*, *Rhea*, *Apteryx*, *Casuarius*, *Dromaeus*, the Dinornithidae, and Aepyornithidae, as well as the Phororhaci, Diatrymae, and Gastornithes, in a superorder Ratitae, the tinamous being placed as an order Crypturi in the Carinatae, next to the Galliformes.

Beddard (1898) did not distinguish superorders of Ornithurae, but

placed all the ratite palaeognaths in one order Struthiones, and the Tinamidae in an order Tinami, stating a close relationship between the two groups in the text, and basing his conclusion on the similarity of palatal structure.

Pycraft (1901), after a study of the osteology, myology, pterylography, and reproductive system of the ratites and tinamous, classed them together in a superorder Palaeognathae, placing the remainder of the ornithurine birds in a superorder Neognathae. Again the point used to establish naturalness of the ratite-tinamou group was the structure of the palate. The palaeognathous birds have the palatine and pterygoid bones articulated by squamous suture, while the neognathous forms are supposed to have the articulation by ball-and-socket joint.

The classification of Pycraft is the one most generally in use today, being the basis of such well-known classifications as that of Wetmore in use by the American Ornithologists' Union.

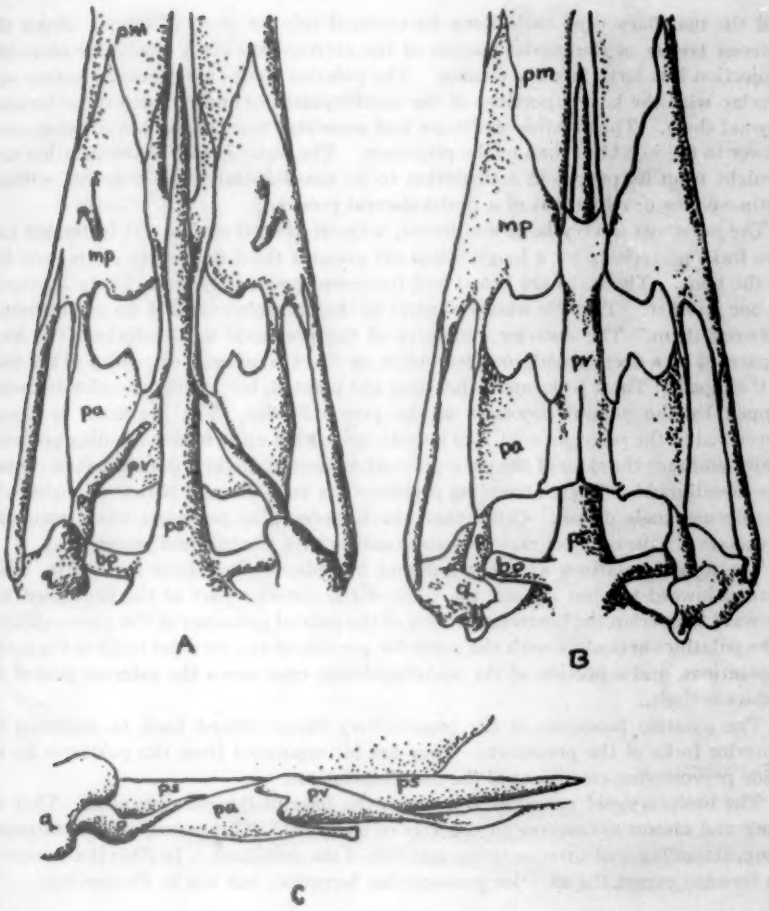
One notable exception is that of Stresemann (1927). He makes no superorders of Neornithes (Ornithurae), but places the palaeognathae in the orders Struthiones, Rheae, Casuarii, Aepyornithes, Apteryges (including Dinornithidae), and Crypturi, all these orders being placed next to one another at the beginning of the classification, immediately preceding the Galli. G. M. Allen (1925) follows a similar scheme.

Percy Lowe has advanced a theory that the Tinamidae are close to the stem-form of the flying birds, while the ratites diverged from the avian stem at a time when the power of flight had not yet been attained but the fore-limbs had become rather wing-like. This theory would necessitate believing that birds had at some stage of evolution sacrificed the use of their anterior limbs in order to acquire flight at a considerably later date, a teleology not acceptable to post-Lamarckian students of evolution. Lowe's theory may be discounted both on these theoretical grounds and on the basis of Fürbringer's study of the wing-musculature of birds.

It seems obvious from the foregoing account that forming a decision on the relationship of the ratites and the tinamous to one another and to the remainder of the birds requires a critical study of the bony palate. It does not seem amiss, therefore, to redescribe the palatal structure of the so-called palaeognaths in some detail.

RHEIDAE

The pterygoid articulates with the quadrate by an extensive ankylosis extending the length of the inferior surface of the orbital wing of the quadrate, and bears a small dorsal lip to receive the basipterygoid process on its quadrate foot. The bone is roughly cylindrical in form and S-shaped in the vertical plane, ascending along



TEXT-FIG. 1.—PALATE OF *RHEA* [RHEIDAE]

A. Dorsal view; B. Ventral view; C. Lateral view. mp = maxillopalatine; p = pterygoid; pa = palatine; pm = premaxillary; ps = parasphenoid; pv = prevomer; bp = basipterygoid process; q = quadrate.

the orbital wing of the quadrate, descending for its short free portion, then ascending again as a long finger-like process running along the dorsal side of the palatine on the latter's mesial margin, then curving inward to contact and ankylose with the dorsal surface of the posterior fork of the prevomer. The pterygoid and palatine are ankylosed where in contact. The pterygoids are separated from the parasphenoid and from one another by the prevomer.

The palatines are in the form of flat bony plates, only the shafts and mesial portions of the external laminae being developed. The latter is sometimes fenestrate. The internal border of the mesial plate sutures with the prevomer and underlaps the external portion of the posterior prevomerine fork. The palatine shaft is very short

and the maxillary runs back along its external side for some distance. From the anterior border of the mesial portion of the external lamina a triangular plate-like projection juts forth into the choana. The palatine shafts articulate by suture and overlap with the lateral portions of the maxillopalatines and do not extend forward beyond them. The palatine shafts are well separated from the mid-line, being much nearer to the jugal bar than to the prevomer. Thç outer border of the palatine runs straight from its pterygoid articulation to its maxillopalatine articulation, without outbowing or development of a posterolateral process.

The prevomer is very large and broad, without ventral carina. It is divided into two forks posteriorly by a longitudinal slit about a third the length of the mid-line of the bone. The forks are broad and truncated posteriorly, and closely appressed to one another. They lie wholly ventral to the parasphenoid and do not include it between them. The anterior extremity of the prevomer is also forked, the forks separated by a deep, broad, rounded notch, so that the anterior extremity of the bone is U-shaped. These forks are rather long and pointed, but almost completely underlapped by the palatal processes of the premaxillaries. The prevomer is closely appressed to the parasphenoid, and its sides are curled up to form ascending processes which embrace the sides of the parasphenoid, extending slightly dorsal to it to contact the mesethmoid. These ascending processes are very low and obtuse triangles with the obtuse angle dorsal. Other than the basipterygoid processes, these ascending processes are the only contact the palate makes with the cranium proper.

The maxillopalatines are very low and flat plates, sometimes fenestrate, which extend inward to abut against the sides of the anterior part of the prevomer, and forward to overlap the posterior portion of the palatal processes of the premaxillaries. The palatines articulate with the posterior portion of the external third of the maxillopalatines, and a portion of the maxillopalatine runs down the external side of the palatine shaft.

The palatine processes of the premaxillary bones extend back to underlap the anterior forks of the prevomer. They are far separated from the palatines by the wide prevomerine extensions of the maxillopalatines.

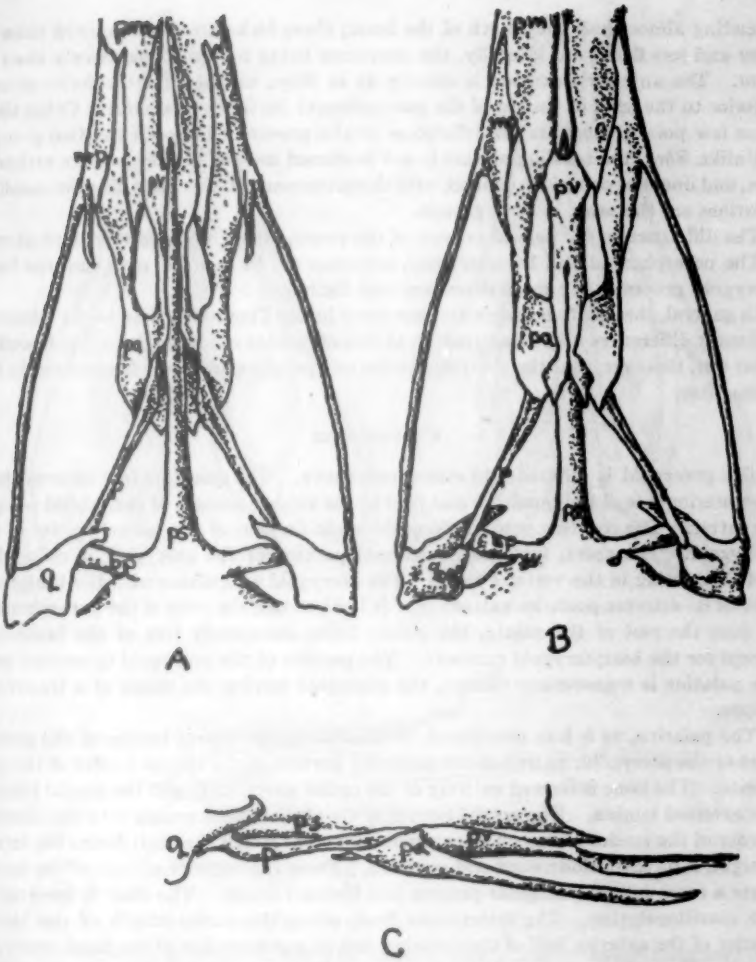
The basipterygoid processes arise from the base of the parasphenoid. They are long and almost transverse to the axis of the skull. The parasphenoid rostrum is long, extending well anterior to the mid-line of the prevomer. In *Rhea* it also exceeds in forward extent the anterior prevomerine furcation, but not in *Pterocnemia*.

TINAMIDAE

The palate is remarkably similar in basic pattern to that of the Rheidae, but there are certain differences in detail.

The pterygoid is much longer, straighter, and more slender, and vertically compressed rather than cylindrical; its foot does not extend far up the ventral border of the orbital wing of the quadrate and presents to the quadrate a small lip extending dorsal to the origin of the shaft; the relations of the pterygoid with the palatine and prevomer are as in *Rhea*.

The palatine differs in not underlapping so much of the posterior portion of the prevomer and anterior portion of the pterygoid; it does not underlap more than the extreme anterior portion of the pterygoid, and occasionally does not completely conceal the pterygoid-prevomer contact. The palatines are much nearer to the mid-line of the skull than in *Rhea*, the shafts being much farther from the jugal bar than from the parasphenoid and prevomer, instead of the reverse; the mesial plate of the external lamina is therefore narrower. There is no anterior free projection of the



TEXT-FIG. 2.—PALATE OF *RHYNCHOTUS* [TINAMIDAE]

A. Dorsal view; B. Ventral view; C. Lateral view. mp = maxillopalatine; p = pterygoid; pa = palatine; pm = premaxillary; pv = prevomer; ps = parasphenoid; q = quadrate; bp = basiptergoid process.

mesial plate. The external border of the palatine is more convex and bulging than in *Rhea*, owing to the greater narrowness of the bone posteriorly, causing the posterior outline to dip inward. The relation of the palatine to the maxillopalatine is as in *Rhea*, but the process of the maxillopalatine extending down the outer surface of the palatine shaft is much narrower. The palatine shaft is much longer and narrower than in *Rhea*. Unlike *Rhea*, the palatal process of the premaxillary extends back to come into contact with the mesial border of the anterior extremity of the palatine shaft.

The prevomer is essentially as in *Rhea*, but the posterior furcation is much deeper,

extending almost half the length of the bone; these forks are more pointed than in *Rhea* and less flared-out laterally, the prevomer being narrower posteriorly than in *Rhea*. The anterior furcation is exactly as in *Rhea*, except that the forks extend anterior to the level of the tip of the parasphenoid (as in *Pterocnemia*). Other than these few points, there are no differences in the prevomer between the two groups.

Unlike *Rhea*, the maxillopalatine is not produced mesiad to the palatine articulation, and does not come into contact with the prevomer. Other than this the maxillopalatines are the same in both groups.

The difference in the palatal process of the premaxillary has been discussed above.

The parasphenoid and basipterygoid processes are as in *Rhea*, save that the basipterygoid processes are more depressed and flattened.

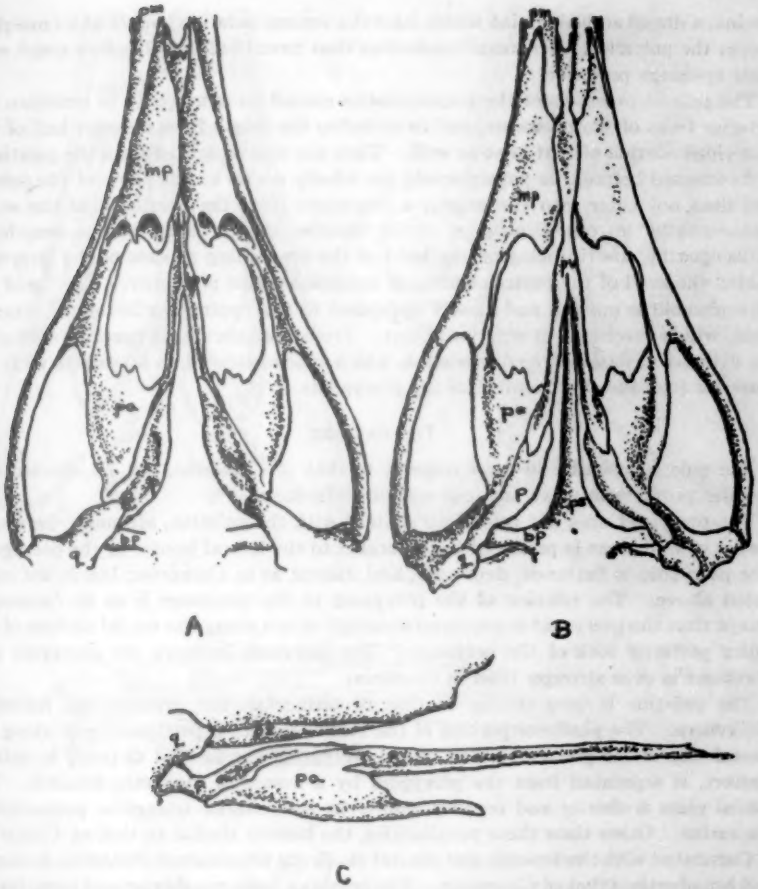
In general, the palate is longer and narrower in the Tinamidae than in the Rheidae, and most differences may be attributed to this difference in proportions. It is well to point out, however, that the maxillopalatine and palatine are never fenestrated in the Tinamidae.

CASUARIIDAE

The pterygoid is inflated and excavated above. The quadrate foot sutures along the anterior face of the quadrate and part of the ventral margin of the orbital wing of the latter. The palatine sutures along the main portion of the lateral border of the pterygoid. The short, free (posteriormost) portion of the pterygoid is cylindrical and descending in the vertical plane. The pterygoid articulates with the basipterygoid at its extreme posterior extremity. It lies beneath the level of the parasphenoid, as does the rest of the palate, the palate being completely free of the brain-case except for the basipterygoid contacts. The portion of the pterygoid in contact with the palatine is transversely dilated, the pterygoid having the shape of a transverse ellipse.

The palatine, as before mentioned, sutures along the lateral border of the greater part of the pterygoid, as well as the posterior portion of the lateral border of the prevomer. The bone is formed entirely of the rather short shaft and the mesial plate of the external lamina. The mesial border of the shaft grades evenly into the anterior border of the mesial plate. The external lamina, of which the shaft forms the lateral margin, is directed downward and outward. From the anterior margin of the mesial plate a more or less triangular process juts forward freely. The shaft is inserted on the maxillopalatine. The latter runs back along the entire length of the lateral border of the anterior half of the palatine, not as a process free of the jugal process of the maxillary, but as a mesiad extension of it, separated by only a very shallow posterior notch. The outer border of the palatine is convex, since it dips inward toward the pterygoid posteriorly. The palatines are well separated from the midline of the skull, the shafts lying much nearer the jugal bar than the parasphenoid and prevomer. The palatine is in contact with only the lateral surfaces of the pterygoid and prevomer, and neither underlaps nor overlaps either bone.

The prevomer is the longest among birds. It lies wholly ventral to the parasphenoid and has no ascending processes, although there are low vertical crests on the dorsal surfaces of the posterior forks. There is no ventral carina, the ventral surface of the anterior portion of the bone being, in fact, concave. The bone is very deeply forked posteriorly by a long and narrow longitudinal fissure, which extends anteriorly to, or almost to, the mid-point of the bone. The posterior forks are perfectly straight, undilated, and separate from one another. These forks underlap the anterior extremities of the pterygoids and ankylose with them. The lateral margins of their



TEXT-FIG. 3.—PALATE OF *CASUARIUS* [CASUARIIDAE]

A. Dorsal view; B. Ventral view; C. Lateral view. mp = maxillopalatine; p = pterygoid; pv = prevomer; pa = palatine; ps = parasphenoid; pm = premaxillary; q = quadrate; bp = basipterygoid process.

posterior extremities suture with the mesial plates of the palatines. Just anterior to the posterior furcation the prevomer is quite narrow. It then broadens anteriorly and at its extreme anterior extremity is slightly forked by a rounded median notch, but the arms of the furcation are quite short. At the junction of the two posterior forks their dorsal carinae fuse to form a single longitudinal dorsal carina which gradually slopes into the flat dorsal surface of the anterior third of the undivided part of the bone. The prevomer is everywhere rather narrow.

The maxillopalatines in their relation to the palatines have already been described. Anteriorly to the palatine articulation the maxillopalatines extend mesiad to contact the sides of the prevomer, and farther forward extend mesially to contact one another dorsal to the prevomer. The maxillopalatines have, in addition to the flat palatine

lamina, a dorsal arched lamina which joins the ventral palatine lamina at its margins, except the posterior. The maxillopalatines thus have the form of hollow cones with their openings posterior.

The palatal processes of the premaxillaries extend back not only to underlap the anterior forks of the prevomer, but to underlap the sides of the anterior half of the undivided portion of that bone as well. They are well separated from the palatines.

As stressed before, the parasphenoid lies wholly dorsal to the plane of the palate, and does not enter into the palate, a departure from the condition of the other 'palaeognaths' except *Dromaeus*. It is likewise shorter than in the remaining 'palaeognaths,' its tip being on the level of the descending process of the lacrymal, behind the level of the posterior point of furcation of the prevomer. The tip of the parasphenoid is pointed and closely appressed to the ventral border of the mesethmoid, which exceeds it in anterior extent. From the base of the parasphenoid arise the cylindrical basipterygoid processes, which extend laterad to articulate with the posterior (quadrate) extremities of the pterygoids.

DROMAEIDAE

The palate is similar in most respects to that of *Casuarius*, but its shorter and broader proportions have induced certain differences.

The pterygoid does not come into contact with the palatine, although the mesial border of that bone is produced back parallel to the lateral border of the pterygoid. The pterygoid is flattened, depressed, and dilated as in *Casuarius*, but is not excavated above. The relation of the pterygoid to the prevomer is as in *Casuarius*, except that the pterygoid is produced anteriad to run along the mesial surface of the entire posterior fork of the prevomer. The ankylosis between the pterygoid and prevomer is even stronger than in *Casuarius*.

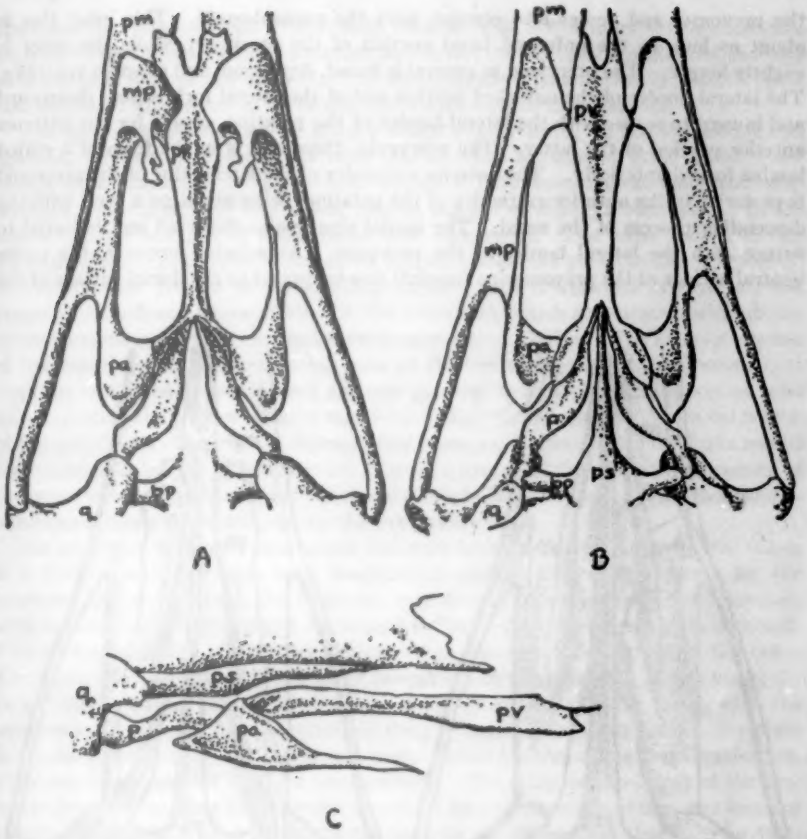
The palatine is very similar to that of *Casuarius*, but presents the following differences. The posterior portion of the mesial surface is produced back along the lateral side of the greater portion of the pterygoid, but instead of being in sutural contact, is separated from the pterygoid by a fissure of moderate breadth. The mesial plate is shorter and broader, and lacks the anterior triangular projection of *Casuarius*. Other than these peculiarities, the bone is similar to that of *Casuarius*.

Correlated with the broader and shorter skull, the prevomer of *Dromaeus* is shorter and broader than that of *Casuarius*. The posterior forks are shorter and more broadly separated than those of *Casuarius*, so that the fissure separating them becomes a triangular notch. This notch extends forward for only a fourth of the length of the prevomer, rather than a half. As in *Casuarius*, the prevomer is narrowest just anterior to the posterior furcation, but broadens anteriorly much more rapidly. Except for these particulars the bone is much the same in both genera.

The maxillopalatines are much as in *Casuarius*, except the anterior cones formed by the dorsal arched laminae are much shorter and blunter, more pocket- than cone-shaped. As in *Casuarius*, the anterior portions of the maxillopalatines overlap the prevomer, but in *Dromaeus* they do not contact one another, a consequence of the broader prevomer.

The palatine processes of the premaxillary are as in *Casuarius*, but almost completely underlap the prevomer-maxillopalatine contact.

The parasphenoid and basipterygoid processes are as in *Casuarius*, except that the median process (rostrum) of the parasphenoid is longer, reaching anterior to the level of the descending process of the lacrymal, about to the mid-point of the prevomer. In addition, this median shaft is keeled and compressed beneath.



TEXT-FIG. 4.—PALATE OF *DROMAEUS* [DROMAEIDAE]

A. Dorsal view; B. Ventral view; C. Lateral view. mp = maxillopalatine; pm = premaxillary; pv = prevomer; pa = palatine; p = pterygoid; q = quadrate; ps = parasphenoid; bp = basipterygoid process.

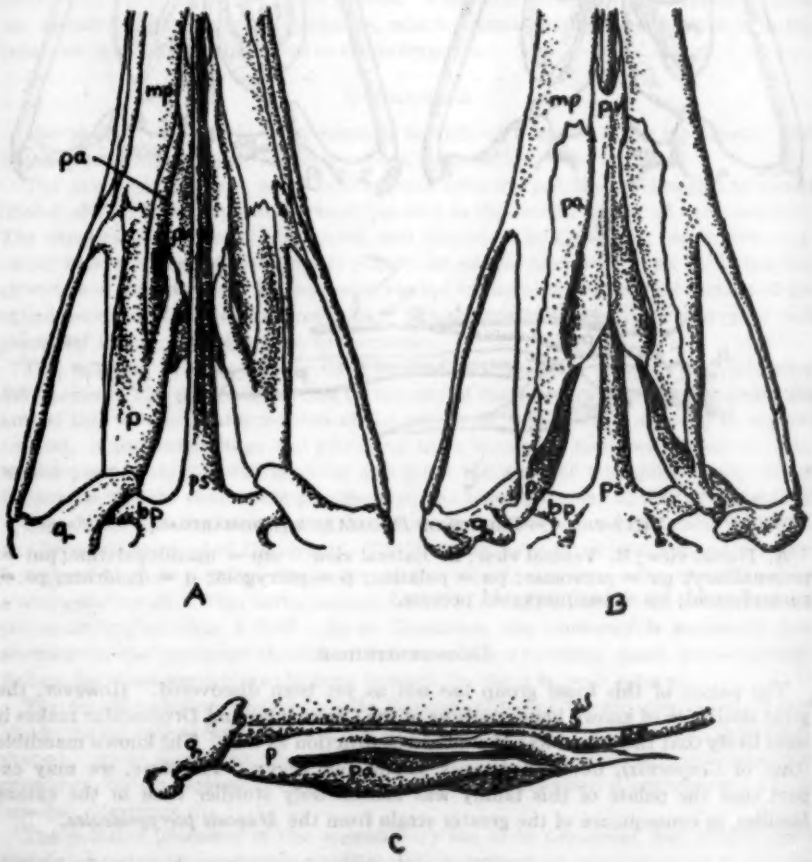
DROMORNITHIDAE

The palate of this fossil group has not as yet been discovered. However, the great similarity of known bones to those of the Casuariidae and Dromaeidae makes it seem likely that the palate was of similar construction as well. The known mandible (that of *Genyornis*), however, is very strong and heavy. Therefore, we may expect that the palate of this family was considerably sturdier than in the extant families, in consequence of the greater strain from the *Musculi pterygoideales*.

APTERYGIDAE

The pterygoid is unique among birds in being forked anteriorly. The outer tine runs along the dorsal surface of the posterior process of the maxillopalatine and the dorsolateral surface of the palatine. The inner fork runs along the dorsal surface of

the prevomer and comes into contact with the parasphenoid. This inner tine is about as long as the unforked basal portion of the pterygoid, while the outer is slightly longer. The pterygoid in general is broad, depressed, and concave ventrally. The lateral border of the unforked portion and of the lateral fork is bent downward and inward to suture with the lateral border of the palatine, except for the extreme anterior portion of the latter. The pterygoid, therefore, is in the form of a curled lamina forked anteriorly. The anterior extremity of the lateral tine of the pterygoid is posterior to the anterior extremity of the palatine, being about on a level with the descending process of the nasal. The mesial tine is also deflected and inflected to suture with the lateral border of the prevomer. Anteriorly, however, the entire ventral surface of the prevomerine (mesial) tine is applied to the dorsal surface of the



TEXT-FIG. 5.—PALATE OF *APTERYX* [APTERYGIDAE]

A. Dorsal view; B. Ventral view; C. Lateral view. mp = maxillopalatine; p = pterygoid; pa = palatine; ps = parasphenoid; pv = prevomer; q = quadrate; bp = basipterygoid process.

prevomer and fused with it. Posteriorly the pterygoid is developed into a transverse circular tongue which fits into a corresponding slot on the ventral surface of the base of the orbital wing of the quadrate. In addition, the lateral border of the pterygoid is in contact with the mesial surface of the orbital wing of the quadrate.

The palatines likewise are of unique shape among birds. They are simple flat laminae, apparently homologous with the external laminae of other birds. But rather than extending downward and outward, they extend downward and very strongly inward, so that the mesial palatal margin of *Apteryx* corresponds to the lateral palatal margins of other birds, and vice versa. The outer border of the palatine of *Apteryx* is sutured for all its length, except the posteriormost extremity, to the posterior process of the maxillopalatine. This process lies external to, and conceals the inflexed lateral border of, the pterygoid, which also sutures with all but the anteriormost extremity of the lateral border of the palatine. The anterior portion of the mesial border of the palatine rests on the ventral surface of the prevomer, so that the combined prevomer and anterior palatine extremities form a sort of false palate, forcing the narrow choanae well back. The middle third of the mesial border of the palatine is concave, but immediately posterior to the middle third the mesial border extends inward as a triangular salient to fuse with the posterior extremity of the prevomer. The anterior extremities of the palatines are sutured with the maxillopalatines and are not contacted by the premaxillaries.

The prevomer is of moderate length but very broad. For its posterior two-thirds it is divided into two forks by a longitudinal sagittal fissure, but, except for the posterior fifth of the bone, the forks are very closely approximated to one another, with their mesial margins turned downward, so that a shallow ventral carina is formed. This carina is carried forward by a blunt ridge onto the solid portion of the bone. The posterior extremities of the forks (about one-fifth the length of the bone) diverge rather strongly from one another, and are truncate distally, fusing with the palatine as above described. Anteriorly the prevomer is shallowly forked, the tines being short and narrow, and appressed to the mesial borders of the maxillopalatines. They are not in contact with the premaxillary. The anterior two-thirds of the prevomer is separated from the posterior one-third by a constriction of the bone forming a neck. Similarly, a neck separates the anterior one-third from the posterior two-thirds, so that the prevomer is divided into three subequal parts. The posterior segment is broadest, the middle segment less broad, while the anterior segment is rather narrow. The lateral border of the posterior two segments of the prevomer is sutured to the deflected outer border of the mesial pterygoid fork, and the entire ventral surface of the mesial pterygoid tine is appressed to the dorsal surface of the middle segment of the prevomer. The lateral borders of the two posterior segments of the prevomer are bent up and thickened to embrace the parasphenoid. The contact of the dorsal surface of the middle segment of the prevomer with the parasphenoid brings the mesial tine of the pterygoid into contact with the parasphenoid as well.

The maxillopalatines are simple flat plates without dorsal laminae. They extend inward to abut against the sides of the anterior segment of the prevomer and are separated by the latter from the parasphenoid in some specimens. The maxillopalatine sutures with the anterior extremity of the palatine, and sends back a strong posterior process which lies external to the lateral pterygoid tine, and sutures along almost the entire lateral margin of the palatine, being excluded from the posterior extremity of the latter by the pterygoid.

The premaxillary has well-developed palatal processes, but these do not extend

backward to the level of the palatine and prevomer, being confined to the ventral surface of the rostrum.

The parasphenoid is compressed and keeled ventrally. It is closely applied to, and embraced by, the prevomer and contacted by the mesial pterygoid tine, but not by the palatine. The parasphenoid is sometimes contacted by the maxillopalatine. It is continued far anterior to the prevomer, curving upward anteriorly. It continues far anterior to the mesethmoid. The basipterygoid processes are broad and depressed plates arising from the base of the parasphenoid and extending to the posterior extremities of the pterygoids.

DINORNITHIDAE

The author has been unable to examine any palatal material of this family, since of the many moa skulls in the American Museum of Natural History, not one retains the fragile bones of the palate. I have been forced to rely, therefore, on the description and lithograph given by Parker (1895). Unfortunately, Parker does not make reference to certain characters here deemed critical.

From Parker's illustration, the palatines are somewhat intermediate between those of the tinamids (and primitive neognaths) and those of *Apteryx;* they are roughly vertical in plane, with the ventral border slightly lateral to the dorsal border posteriorly. Posteriorly the dorsal palatine border sutures with the lateral border of the prevomer, as in all birds except *Apteryx* and *Struthio.* The unforked pterygoid apparently overlaps the prevomerine-palatine suture, ankylosing with both bones. This is suggestive of *Apteryx,* having similar relations to the forked homologous bone of the latter, but with the tines appressed to one another (a consequence of the apposition of the prevomer and palatine) and either fused to one another or not yet separated. This condition is superficially like that found in the Rheidae and Tinamidae, but in these the pterygoid overlaps the prevomer, then curves backward and outward to overlap the palatine; moreover, the pterygoid of the moas is plate-like, as in *Apteryx,* rather than cylindrical or compressed. The prevomer is very deeply divided sagittally, or even paired, as in *Apteryx.* The prevomer, according to Parker, embraces the parasphenoid and runs forward, overlapping the maxillopalatines to contact the premaxillary. (Overlapping of the maxillopalatines by the prevomer is unique among palaeognaths and suggests numerous neognaths, such as the Passeriformes and some Procellariiformes). From Parker's illustration, the maxillopalatines, though coming very close to the mid-line of the skull, are not produced abruptly mesiad to the palatine, and the premaxillary does not contact the palatine. All this is as in *Apteryx.* There is no false palate in the moas; hence the peculiarities of the palatine found in *Apteryx* are not so much in evidence.

Parker believed the palate of the Dinornithidae most nearly resembles that of the Apterygidae. Beddard (1898), however, believed that *Rhea* shows the closest similarity. Most of the similarities between the Rheidae and Dinornithidae seem to be merely primitive avian characters; however, without direct study of material, the author would not like to take a definite position.

AEPYORNITHIDAE

As in the case of the *Dinornithidae,* the author has been unable to examine material of this fossil family, owing to the absence of any skulls of this group from the collections of the American Museum of Natural History. I have relied, therefore, on the account of the palate of *Aepyornis hildebrandti* given by Lamberton (1930). Lamberton's account is not altogether clear on some points here deemed essential (*e. g.,*

whether or not the pterygoid is furcate) and his illustration is a photograph in which it is difficult to determine sutures and which does not show a dorsal view of the anterior part of the palate. With these reservations, I attempt a secondary description based on Lamberton's work.

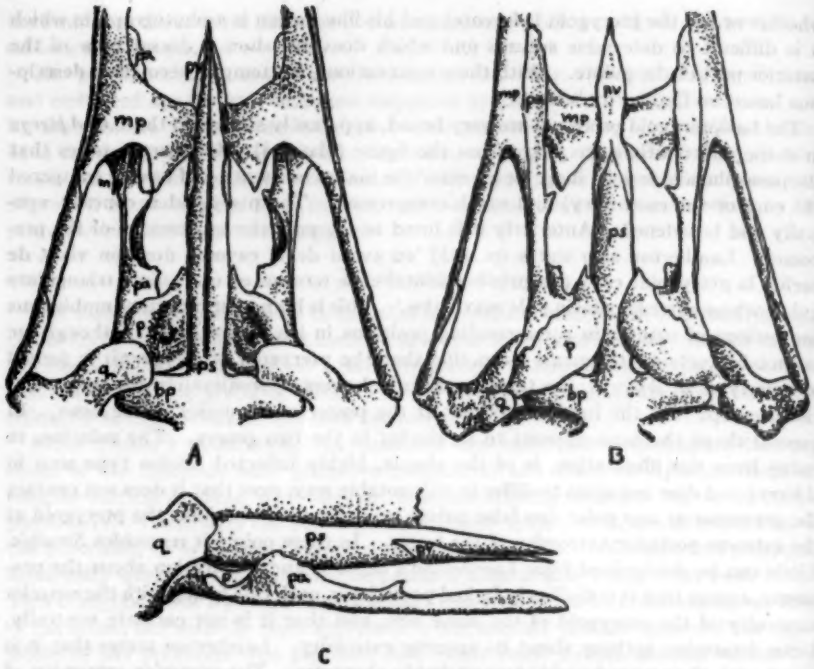
The basipterygoid processes are very broad, apparently similar to those of *Apteryx* in shape and relations, to judge from the figure (plate vi). Lamberton notes that the parasphenoid is very short for a 'ratite' (he makes no mention of having compared the emu or the cassowary) and much compressed. The pterygoid is concave ventrally and broadened. Anteriorly it is fused to the posterior extremities of the prevomer. Lamberton also states (p. 155) 'en avant de la caverne dont on vient de parler, la ptérygoide est à peu près horizontal et se termine en une pointe triangulare qui s'insinue entre le palatin et le maxillaire.' This is borne out by rather ambiguous suggestions of sutures in corresponding positions in his illustration. Although we cannot be certain, it appears from this that the pterygoid of *Aepyornis* is forked anteriorly as in *Apteryx*, the tines apparently having approximately the same relations, except that the furcation occurs at the posterior extremity of the bone. In general shape the bone appears to be similar in the two genera. The palatine, to judge from the illustration, is of the simple, highly inflected lamina type seen in *Apteryx* and does not seem to differ in any notable way, save that it does not contact the prevomer at any point (no false palate being formed) and joins the pterygoid at the extreme posterior extremity of the latter. In these points it resembles *Struthio*. Little can be determined from Lamberton's account and illustration about the prevomer, except that it is shallowly forked posteriorly, each tine fusing with the anterior extremity of the pterygoid of the same side, and that it is not carinate ventrally. I can determine nothing about its anterior extremity. Lamberton states that it is fused with the parasphenoid, a remarkable character. The posterior extremity of the prevomer apparently slightly underlaps the anterior extremity of the pterygoid. The maxillopalatine apparently sends back a process which runs along the entire dorsal border of the palatine, except where separated by the lateral tine of the pterygoid, to join the posterior extremity of the pterygoid. The sutures of the anterior palate cannot be made out from Lamberton's figure, but apparently the palatal process of the premaxillary broadly contacts both the prevomer and the palatine. The anterior palate seems unusually complete, forming a solid and continuous wall of bone anterior to the chaonae. Altogether, the posterior palate is very similar to that of *Struthio*, except that the prevomer contacts the pterygoid (in *Struthio* a ligament hints at a similar connection) and the pterygoid apparently has an outer prong as in *Apteryx;* but the anterior palate and parasphenoid seem to be as different as could be imagined.

EREMOPEZIDAE

The fossil fragments ascribed to the Aepyornithidae from the continent of Africa are, on the whole, very poorly known. No palates have yet been discovered. *Eremopezus*, known from a tibiotarsus, shows no particular resemblance to the Aepyornithidae, and in many characters (*e. g.*, the deep intercondylar groove) is quite different and more nearly resembles *Struthio*. Nothing as yet can be said of the relationships of this group.

STRUTHIONIDAE

The pterygoids are reminiscent of *Casuarius*. Their posteriormost extremities are cylindrical and decurved from the greater part of the bone. The posterior



TEXT-FIG. 6.—PALATE OF *STRUTHIO* [STRUTHIONIDAE]

A. Dorsal view; B. Ventral view; C. Lateral view. mp = maxillopalatine process; p = pterygoid; pa = palatine; ps = parasphenoid; pv = prevomer; bp = basipterygoid process; q = quadrate.

extremity sutures with the anterior face of the condyle of the quadrate and the ventral portion of the anterior margin of the orbital wing of the quadrate. Anterior to the very short posteriormost cylindrical portion of the bone, the pterygoid is dilated into a broad ellipse, the maximum breadth being about half the length of the bone. This ellipse is excavated above, with the outer wall of the excavation much stronger than the inner. The palatine sutures along the middle third of the lateral border of the pterygoid, but does not underlap it. The anterior half of the mesial border of the pterygoid lies against the parasphenoid, or may lie below it, the pterygoid being capable of some movement in the vertical plane. The mesial borders of the pterygoids are only moderately separated from one another, the pterygoids being less broadly separated than in other 'Palaeognathae.' The anterior extremities of the pterygoids are pointed. The pterygoid is well separated from the prevomer, but a tough ligament connects the anterior extremity of the pterygoid with the posterior extremity of the prevomer. This ligament may represent the posterior portion of the latter.

The palatines differ from those of other palaeognaths in possessing both internal and external laminae, although the internal lamina is slight. The internal lamina is in the form of a rather narrow horizontal shelf jutting off from the mesial surface of the palatine shaft. It is broadest anteriorly, where it forms the main part of the bone and underlaps the maxillopalatine and fuses with it. At about the mid-point

of the palatine the internal lamina develops a triangular spine which projects forward and mesially to be connected by ligament with the posterior spine of the dorsal lamina of the maxillopalatine (as in Anseres). The external lamina is represented entirely by the mesial plate, which rises almost vertically from the shaft and contacts neither prevomers nor parasphenoid. It is much reduced, being confined to the posterior half of the bone. It originates at the dorsal surface of the mesial triangular process of the internal lamina and runs back along the lateral border of the shaft. Posteriorly the palatine broadens out to suture with the middle third of the outer border of the pterygoid. The relation of the palatine to the maxillopalatine is complex, since the maxillopalatine has two laminae, a dorsal and a ventral, as in *Casuarius* and *Dromaeus*. The ventral lamina is flat and runs along the outer edge of the palatine for most of the length of the latter. The dorsal lamina of the maxillopalatine is arched and convex dorsally and runs mesially to unite again with the ventral lamina. Against the ventral surface of the united ventral and dorsal laminae is fused the dorsal surface of the internal lamina of the palatine. In addition, the dorsal lamina of the maxillopalatine, which extends mesially to articulate with the prevomer, sends back from its posterior margin a triangular plate, the apex of which articulates by ligament with the apex of the triangular mesial process of the internal palatine lamina, as above described. The palatine makes no contact with the prevomer. The anterior extremity of the palatine projects freely a short distance anterior to the maxillopalatine (*Struthio c. australis*) or is delimited anteriorly by the anterior margin of the maxillopalatine (*S. c. camelus*). The lateral margin of the palatine is straight. The palatine does not touch the premaxillary and is broadly separated from its fellow.

The prevomer is short, forked behind, and pointed anteriorly. It contacts neither pterygoid nor palatine, owing to its extreme anterior position on the parasphenoid, the prevomer being much shorter than in remaining palaeognaths. It is applied closely to the parasphenoid. For its anterior two-thirds it is applied to the ventral surface of the parasphenoid and is simple, pointed, and flat. The posterior third, however, is furcated by a broad triangular notch, the tines extending halfway up the sides of the parasphenoid to embrace it. The maxillopalatines make squamous suture with the middle third of the sides of the prevomer (just anterior to the sides of prevomerine forks) and slightly overlap, as in some *Apteryx*, the prevomer to make contact with the parasphenoid. The prevomer extends forward, tapering to a point, approximately to the tip of the parasphenoid, but may exceed or fall short of it. It is not approached by the premaxillaries.

The relations of the maxillopalatine to the palatine have been described above. As mentioned above, the maxillopalatine is of a bilaminate type, as in *Casuarius* and *Dromaeus* (and Anseres). Unlike these genera, however, the two laminae, in uniting together, do not make a pocket or cone extending forward to the anterior extremity of the maxillopalatine, but form only a short fossa, the anterior portion of the maxillary being a flat lamina. As above mentioned, the maxillopalatines extend mesiad to contact the prevomer and the parasphenoid.

The premaxillaries are entirely devoid of palatal processes, and do not at all enter nto the formation of the palate or contact any of its bones.

The parasphenoid and basipterygoid processes are much stouter than in other birds. The parasphenoid is very stout, rounded below, and constricted just anterior to the basipterygoid processes. It is pointed terminally and far exceeds the mesethmoid in anterior extent, though this is concealed in the adult by ossification of the internarial membrane. The parasphenoid is in contact with the pterygoid and

prevomer, but not the palatine. It is contacted by the maxillopalatine as described above. The basipterygoid processes arise at the base of the sagittal parasphenoid spike, and extend laterad and normal to the parasphenoid to contact the posterior thirds of the pterygoids; they are very broad and stout and elliptical in cross-section, being somewhat depressed.

INTERRELATIONSHIPS

The families herein described (Struthionidae, Rheidae, Casuariidae, Dromornithidae, Dromaeidae, Aepyornithidae, Eremopezidae, Dinornithidae, Apterygidae, and Tinamidae) have, since Pycraft (1901), been considered as closely related and constituting a special superorder of Neornithes, the Palaeognathae characterized by possessing a 'dromaeognathous' palate. It is the author's contention that the palate cannot be used to define such a superorder of birds, and, indeed, seems rather to separate the Palaeognathae into several groups.

I. THE IMPOSSIBILITY OF DEFINING THE PALAEOGNATHOUS PALATE

The standard definition of the palaeognathous or dromaeognathous palate is that of Huxley (1867) as a palate in which the posterior extremity of the prevomer is produced back to receive the anterior extremity of the pterygoid and posterior extremity of the palatine, separating both these bones from the parasphenoid. This definition will do very well for *Rhea* and the Tinamidae, but is quite inadequate for the entire group for these reasons:

1. As Beddard (1898: 139) points out, *Struthio* would be excluded by this definition, since the prevomer is not in contact with the pterygoid, which touches the parasphenoid. In *Apteryx*, also, the pterygoid contacts the parasphenoid. In the Struthionidae, Apterygidae and Aepyornithidae the posterior extremity of the palatine does not contact the prevomer.

2. Some neognaths, such as *Anhima* and the Anseres, have pterygoids which are only narrowly separated from the prevomer, rendering the distinction trivial.

3. In many neognaths the palate is suspended beneath the parasphenoid rostrum, so that neither the pterygoid nor palatine contacts it. Examples are such well-known birds as the common fowl and duck. The same condition exists in *Casuarius* and *Dromaeus*.

Huxley also states that the prevomer is large in dromaeognathous birds. The prevomer of *Struthio* cannot be called large by any standard, while several neognaths, such as *Diomedea* have relatively larger prevomers than do *Apteryx* or the Tinamidae.

The backward position of the basipterygoid processes, the third

point of Huxley's definition, can be matched by the Musophagidae and Turnicidae among the Neognathae.

Pycraft (1901) was, in fact, forced to reduce his definition of the palaeognathous palate to a palate in which the pterygoid and palatine articulated by squamous suture, the Neognathae supposedly having an articulation by ball-and-socket. This definition, also, falls short for these reasons:

1. In *Dromaeus* there is no contact at all between the palatine and the pterygoid.

2. Numerous Neognathae have a squamous sutural articulation between the pterygoid and palatine. Examples are the Galli, Anhimae, Anseres, and Sagittarioidae.

3. The details of this squamous suture are quite different in the various groups of the Palaeognathae, and therefore, real similarity must be considered dubious (*see* below).

The writer has had no more success than Huxley or Pycraft in finding characters to define the dromaeognathous or palaeognathous palate. He must conclude, therefore, that the palaeognathous palate is undefinable.

II. THE DIVERSITY OF THE PALAEOGNATHOUS PALATE

The author feels, however, after consideration of the morphological data assembled above, that the families of Palaeognathae may all be assigned to four well-defined palatal types, with a possible fifth type for *Aepyornis*, of which the palate is imperfectly understood. These types are:

1. The Tinamiform type: The prevomer is large, its halves imperfectly fused, the bone being deeply furcate before and behind; it embraces the parasphenoid, the palate thus being bound to the braincase. The palatines lack internal laminae; their ventral borders lie far lateral to their dorsal borders. There is no false palate. The posterior portion of the dorsal border of the palatine slightly underlaps and fuses with the lateral border of the posterior extremity of the prevomer. The pterygoid overlaps and sutures squamously with the prevomer, then curves backward and outward to overlap and ankylose with the posterior extremity of the palatine; it is cylindrical or compressed and slender, the maxillopalatine is unilaminate. The premaxillary has a strong palatal process.

Rheidae (Pliocene to Recent of South America); Tinamidae (Pliocene to Recent of Central and South America).

2. The Casuariiform type: The prevomer is long, but rather narrow, its halves imperfectly fused, the bone being shallowly furcate anteri-

orly, rather deeply furcate posteriorly. The entire palate, including the prevomer, lies wholly ventral to the parasphenoid, not contacting it, and is free of the brain-case, except at the basipterygoid facets. The palatines lack internal laminae, their ventral margins lying well lateral to their dorsal margins, and do not contact the prevomer except at the posterior extremity. There is no false palate. The pterygoid is simple and transversely plate-like, its anterior extremity ankylosed to the posterior extremity of the prevomer, there thus being formed an arch. To the lateral surface of this arch the mesial border of the posterior part of the palatine fuses. The pterygoid contacts neither parasphenoid nor maxillopalatine. The premaxillary has a strong palatal process underlapping the anterior extremity of the prevomer. The maxillopalatine is bilaminate. The parasphenoid is reduced.

Dromaeidae (Pleistocene to Recent of Australia); Casuariidae (Pleistocene to Recent of Australian region). Almost undoubtedly also Dromornithidae (Pleistocene of Australia).

3. The Struthioniform type: The prevomer is much reduced by loss of its posterior half. Its halves are well fused, the bone being pointed anteriorly and rather shallowly furcate posteriorly. It is nowhere in contact with the pterygoid or palatine, but embraces the parasphenoid. The palatines have narrow internal laminae, giving them an L-shaped cross-section. The ventral border of the palatine is lateral to the dorsal border. There is no false palate. The palatine sutures along the lateral border of the pterygoid and its anterior extremity extends to or beyond the anterior margin of the maxillopalatine. The maxillopalatine is bilaminate. The pterygoid is simple and plate-like, its anterior extremity contacting the parasphenoid. The pterygoid contacts neither prevomer nor maxillopalatine. The premaxillary has no palatal processes. The parasphenoid is long and stout.

Struthionidae (Pliocene to Pleistocene of Europe, Asia, and Africa; Recent of Africa and western Asia). Possibly, also, Eremopezidae (Eocene to Oligocene of Africa).

4. The Apterygiform type: The prevomer is rather large, its halves imperfectly fused, the bone being shallowly furcate (? as to Aepyornithidae) anteriorly, and deeply furcate posteriorly, or even paired. The prevomer embraces the parasphenoid, binding the palate to the skull. The palatines lack internal laminae, *but are decidedly inverted, their ventral borders being beneath or mesial to their dorsal borders.* The palatine sutures with the lateral margin of the pterygoid. The pterygoid is plate-like, and forked (Apterygidae, Aepyornithidae [?]) or simple (Dinornithidae). It ankyloses with the dorsolateral border

of the posterior extremity of the prevomer. The pterygoid thus contacts the palatine and the prevomer simultaneously (or, in those forms in which the pterygoidal and palatine parts of the pterygoid are separated from one another by a fissure, separately), rather than contacting the prevomer first, then contacting the palatine more posteriorly, as in the Tinamiform type. Maxillopalatines unilaminate. The premaxillary has a strong palatal process. In all but the Dinornithidae the maxillopalatine contacts the pterygoid.

Apterygidae (Pleistocene of Australia; Pleistocene to recent of New Zealand). Dinornithidae (Pleistocene of New Zealand). ?Aepyornithidae (Pleistocene of Madagascar).

There are two possible explanations of this diversity:

1. The so-called palaeognaths are truly closely related, but the palate has become so variable as to lose significance in determining affinities (Hypothesis of unity).

2. The Palaeognathae are not a natural group (Hypothesis of disunity).

Let us examine these hypotheses.

III. THE HYPOTHESIS OF UNITY

If we are to believe that the palate is variable to such an extent that we cannot use it to define the Palaeognathae, then we are faced by a dilemma, for it is on the very basis of the palate that the Palaeognathae have been separated from the Neognathae and held to be homogeneous. To accept the hypothesis of unity of the Palaeognathae requires that we invalidate the definition of the group offered at present. Until other criteria are offered, therefore, we must, in duty to scientific doubt, deny the unity of the Palaeognathae.

IV. THE HYPOTHESIS OF DISUNITY

Accepting the refutation of the hypothesis of unity, we must accept the validity of the present alternative. We may further consider the possible explanations of disunity.

1. The families of palaeognaths have evolved from a common ancestor along at least four main phylogenetic lines, these lines having become as distinct from one another morphologically in regard to the palate as from the Neognathae (Hypothesis of common ancestry).

2. The families of palaeognaths have descended from several very distinct ancestors (united, of course, at the common Neornithic stem) (Hypothesis of archaic diversity).

3. The families of palaeognaths have descended from groups of

Neognathae, acquiring a secondarily primitive palate (Hypothesis of reversal).

Hypotheses 1 and 2 imply that the palates of the palaeognaths are in truth primitive; that is, the path of morphological change has followed the path of genetic evolution. Hypothesis 3 assumes that morphological change has at some point reversed itself and become negatively, rather than positively, correlated with genetic evolution. Let us consider this latter possibility.

V. THE HYPOTHESIS OF REVERSAL

There is some evidence to indicate at least the possibility of truth of this hypothesis.

1. The similarity of the palate of the Rheidae to that of the Tinamidae is also borne out by similarities in the nasals, lacrymals, calvarium, costal processes, hypotarsus, sculpture of leg-bones, coiling of gut, etc. This resemblance is so great, in fact, that close phylogenetic relationship seems unavoidable. Now, for many reasons, such as wing-like form of the anterior limb, myology of the anterior limb, the philosophical reasons given in the discussion of Lowe in the historical account, etc., it seems fairly definite that the ratite forms have evolved from flying forms, and, therefore, that *Rhea* is evolved from the Tinamidae, rather than the reverse. But the palate of *Rhea* is more 'primitive' than that of the Tinamidae in several respects: (a) the palatines are more broadly separated; (b) the pterygoid is shorter; (c) the palatine does not contact the premaxillary; (d) the prevomer is broader. Here we apparently have an example of evolution proceeding from a less to a more primitive condition of palate. Since it has apparently happened here, can we not say it may possibly have occurred in other palaeognaths?

2. There are numerous examples in zoology of neoteny having worked morphological reversals. Examples are the Sphenisci, where neoteny has produced a less fused, and therefore more reptilian, tarsometatarsus (*see* Simpson, 1946), and the Urodela, where several morphologically primitive forms were shown (*see* Noble, 1931) to be neotenic forms of several distinct families (Hynobiidae, Amblystomidae, and Salamandridae), whereas they had previously been placed in one group, the 'Perennibranchiata.' Now, there are several indications of neoteny in the skulls of the 'Palaeognathae,' in addition to the numerous indications of neoteny in the wings and pelvis (as the failure of the ilium and ischium to coössify posteriorly). Examples of neoteny in the skulls of 'palaeognaths' are:

a. The failure of the anterior bony nares to close behind and

become separate from the preorbital fossa. This cannot be looked upon merely as a retained reptilian character, for in Archaeopterygidae (Heilmann, 1926) the nares and the preorbital fossa are separated by a buttress of bone formed from the maxillary and nasal and premaxillary. In the Pseudosuchia, which Heilmann gives us good reason to regard as ancestral to the Aves, the same condition exists, as shown by published figures (*see* Heilmann, 1926; Broom, 1913; von Huene, 1920; Broili and Schroeder, 1934–1937, pt. 5). We can only regard this as retention in the adult of an embryonic character (neoteny).

b. Failure of the cranial sutures to close, at least until senescence.

c. The tendency for the eustachian canals to remain open or partly open inferiorly, most obvious in the Apterygidae and Aepyornithidae.

We must not forget that neoteny is usually not limited to a specific organ. Thus, neotenic persistence of gills in the 'perennibranchs' is accompanied by neotenic skull-characters and muscular characters, and neoteny in the tarsometatarsus of the Sphenisci is accompanied by late obliteration of the cranial sutures. We may, therefore, expect that the neoteny of the wings of the ratites might affect the palate.

Neoteny might easily explain such a palatal characteristic as the imperfect fusion of the halves of the prevomer. Pycraft, in the 'Infancy of Animals,' states that neognaths go through a *Dromaeus*-like stage of development in respect to the prevomerine-pterygoid contact, the difference being produced by fusion of the hemipterygoid (the connecting piece) to the palatine. If this is true, then neoteny could also explain the pterygoid-prevomer contact, the heart of Pycraft's definition of the 'Palaeognathae.'

3. Although all the 'palaeognaths' show some characters which appear primitive, there is no particular agreement among the various groups as to exactly which 'primitive' characters are exhibited. We may consider the so-called primitive characters of the 'palaeognaths':

a. A large prevomer. We may first doubt the primitiveness of this feature, since in none of the Archaeosauria can the prevomer be considered relatively large, while in such primitive pseudosuchians as *Chasmatosaurus* (*see* Broili and Schroeder, 1934–1937, pt. 5) the prevomer is quite small. Secondly we may point out that the prevomer of such neognaths as *Diomedea* and *Puffinus* is large, while the Passeriformes have the prevomer of broad and flat form as in the 'palaeognaths.' Thirdly, the prevomer of *Struthio* is not large.

b. Furcation of the pterygoid. This is a character seen in such

Pseudosuchia as *Ornithosuchus* (*see* illustration in Heilmann, 1926). It is found in *Apteryx* and *Aepyornis* but not in other birds. Even here it may be explained by adaptation (*see* below).

c. Imperfect fusion of halves of prevomer. Reptilian, but see discussion above. This character is not shown by *Struthio* to any greater extent than by numerous neognaths, such as Pici and Charadrii.

d. Articulation of palatine with lateral border of pterygoid, rather than with ventral surface of anterior extremity of latter. Reptilian, but not indicated in Tinamidae or Rheidae.

e. Pterygoid plate-like in form. Possibly reptilian, but not indicated in Tinamidae or Rheidae, and approached by such Neognathae as recent Spheniscidae, but not by ancient Spheniscidae (*see* Simpson, 1946).

f. Pterygoid contacting prevomer. Reptilian, but see discussion above. Not seen in *Struthio*.

g. Long parasphenoid. Doubtfully reptilian. Not so in *Casuarius, Dromaeus, or Aepyornis*. The parasphenoid is rather long in such neognaths as *Phalacrocorax*.

The author has not been able to find one primitive palatal character common to the 'palaeognathous' forms and not also found in Neognathae. He finds himself unable to believe, therefore, that this group represents a uniform primitive avian stock. Moreover, since no one of the four palaeognathous types enumerated above seems more primitive than any other, he finds it hard to believe these stocks represent successive offshoots from the primitive avian stem.

4. It occasionally happens that typical neornithic birds will show individual mutations of a 'palaeognathous' nature. An example is Lowe's discovery of a hummingbird skull in which the pterygoid fused to the prevomer. Other such cases are known (*see* note in Oliver, 1945). Picidae also frequently approach this condition. This would seem to indicate that neognaths have in their genotypes potentialities for the 'palaeognathous' palate.

5. The variation between individuals in palatal structure among Palaeognathae may indicate that palatal characters of the families are fairly recently acquired and not yet stabilized. Examples are the variability of fenestration of the palatine and maxillopalatine in the Rheidae, the variability as to parasphenoid-maxillopalatine contact in the Apterygidae. Pycraft (1901) has defined the subspecies of *Struthio camelus* by differences in the structure of the palate.

6. Although these large-boned birds inhabiting arid regions might be expected to be the most easily fossilized birds, and are, in fact very

frequent (for birds) in Pleistocene deposits, not one family definitely known to possess a 'palaeognathous' palate is known from pre-Pliocene deposits. Yet such brittle-boned forest forms as Passeres are represented in the Eocene by such genera as *Laurillardia* and *Palaegithalus*. This leads one to be somewhat dubious of the antiquity of the 'Palaeognathae.'

It must be remembered, however, that definitely neognathous forms with neotenic wings, such as *Strigops* and *Didus*, show typically neognathous palates. This need not cause us to deny validity to the reversal hypothesis for there is no reason why all neoteny should affect the palate, any more than that all neoteny should not do so. If the dodo had undergone serious palatal changes, it is possible that its neognathous affinities would not have been realized, and it would be considered to bear the same relation to the Columbae that the Tinamidae are considered to bear to the Galli. (The author is indebted to Dr. Ernst Mayr for the suggestion of possible reversion in the Palaeognathae.)

VI. POSSIBILITIES OF ADAPTATION

Certain of the features of the 'palaeognathous' palate may also be explained by adaptation and convergence. An example is the false palate of *Apteryx*. *Apteryx* is highly specialized as an helminthophagous form, the specialization including a very elongate beak with the nostrils terminal, thus forming a sensitive probe. Now, the mammalian genus most nearly paralleling *Apteryx* in habits is *Myrmecophaga*, and here again we see great extension of the false palate, which is longer in this latter genus than in any other mammal. This in itself hints that false palate-formation is coördinated with insectivorous habits. A possible explanation is that the internal nares are brought back into closer fit with the glottis, the greater respiratory efficiency thus achieved perhaps compensating for the greater difficulty in drawing a column of air through the beak, which has been greatly lengthened for the helminthophagous method of feeding. The furcate pterygoid of *Apteryx* seems to the author to be another adaptation correlated with the false palate, rather than a real resemblance to *Ornithosuchus*. The false palate of the kiwi is formed by a strong inversion of the palatines. Unless the axis of rotation of the palatine had passed along the dorsal border of the bone, which it has not, the inward rotation of the normally lateral ventral border would produce an outward rotation of the dorsal border. This outward rotation of the dorsal border of the palatine has separated the portion of the pterygoid which runs along it from the portion of the pterygoid which

runs along the outer border of the prevomer. In *Aepyornis*, although there is no false palate, the palatine is rotated as in *Apteryx*, and the pterygoid is likewise furcate. The Dinornithidae, which in most palatal characters, as well as in structure of the rest of the skeleton, resemble *Apteryx*, have very short beaks and no false palate, and therefore the pterygoid is simple.

As to the solid connection of the pterygoid with the palatine found in this group, this modification seems to be coördinated with the fact that this group lacks the cranio-facial hinge found in numerous neognaths, particularly in Psittaci. In hinge-faced birds the pterygoid acts as a connecting bolt between the quadrate, which initiates the forward push, and the palatine, which conveys this push to the rostrum. Now, since the quadratic foot of the pterygoid moves in a circle around a centre which is the squamosal-quadrate articulation, it has an upward movement (y):

$$y = \sqrt{r^2 - x^2}$$

where r (the radius) is the distance from the pterygoid-quadrate articulation to the squamosal-quadrate articulation, and x is the horizontal movement of the pterygoid-quadrate articulation. The palatine, however, is almost incapable of movement in the vertical (y) direction, and thus the pterygoid must be able to rotate vertically around the palatine articulation if it is to maintain connection with both palatine and quadrate while the mechanism is in motion. The hinge-faced birds always have a loose and mobile articulation between pterygoid and palatine. The 'palaeognaths,' however, are, with the exception of *Apteryx* and the tinamous, grazing birds, requiring a solidly fixed upper mandible, so that a strong pinching action may be exerted at the tip, while the tinamous feed to some extent on roots and require a similarly strong pinching power. *Apteryx* frequently uses the bill as a crutch and requires a stable upper mandible. Hence we find that the palate has been locked in place by ankylosis of the pterygoid and palatine, while the pterygoid-quadrate articulation has been soldered together not only by the firm union of these bones, but by the posterior position of the basipterygoid processes, which come to bear directly on the pterygoid-quadrate articulation. Thus three characters of the palaeognathous palate may be explained adaptively, and hence are open to suspicion of convergence. In neognaths which lack the cranio-facial hinge, such as *Sagittarius*, the pterygoid-palatine articulation is usually strong and palaeognath-like.

The large ratites (*Rhea*, *Struthio*, *Casuarius*, and *Dromaeus*) have specialized toward the enlargement of the gape, probably to facilitate

the swallowing whole of large objects. (The propensities of the ostrich in this direction are proverbial.) Dr. George G. Simpson, who has had considerable experience with *Rhea*, informs me that this bird is quite proficient as a fly-catcher, and enlargement of the gape in this genus may be correlated with this. This broadening of the mouth may be responsible for such characters as the broadened prevomer and wide separation of the palatines. In the Tinamidae, where the mouth is not broadened, the palatines are not widely separated and the prevomer is not particularly broad.

In conjunction with the enlargement of the mouth in these birds, the tongue has become much reduced, so as not to obstruct the pharyngeal passage. This has resulted in a lower, flatter, less arched palate, owing to reduction of lingual pressure. In the Procellariiformes, among Neognathae, the tongue is similarly reduced and the palatines lie low in the skull, among some Hydrobatoidea below the level of the jugal arch.

The larger ratites lay relatively thick-shelled eggs, apparently a specialization required of birds which lay conspicuous eggs on the ground, usually in unprotected places. Dr. Simpson has suggested to me, quite rightly, that the great weight of the incubating father is at least partly responsible for this thickness of egg-shell. This thick shell must present a serious problem to the chick attempting to peck its way out. This pecking must jar the palate considerably and require considerable force to be conveyed along it. This may account for the sturdier and more massive form of the bones of the palate in the ratites than in the Neognathae. The tinamous have thin-shelled eggs and their palatal bones are thin and no stronger than in the average neognath.

VII. THE HYPOTHESES OF COMMON ANCESTRY AND OF ARCHAIC DIVERSITY

We have presented what evidence there is for believing that the palates of the 'Palaeognathae' are not primitive, but either neotenic reversals or adaptive developments. We may now consider the possibility that the palatal patterns exhibited by these birds are, in truth, primitive. Assuming this, we again have a choice between believing: (1) that the four main types outlined above are independent of one another down to the basic Neornithic stem; or that (2) the four main lines come from a common ancestor in turn derived from some other neornithic (ornithurine) group. The author feels the morphology of the palate of known forms is inconclusive in making this choice. No one of the four groups here defined seems any more like one of the others or like the Neognathae than do the rest. Only on palaeonto-

logical evidence not as yet presented to us could the affinities with one another of these four lines be judged from the palate alone. Since palaeontology has up to now failed us, we must rely on morphology of other systems. But here we seem to be presented with equally inconclusive evidence. The pelvis of the Rheidae is as different as could be imagined from that of the Tinamidae, while the rest of the anatomy of the two groups is strikingly similar. Similar difficulties beset us with other systems.

But although we cannot as yet determine the affinities of these lines with one another, we can make some statements concerning phylogeny within the particular lines:

Tinamiform line: As discussed above under the section v, the Tinamidae appear to be the basal stock. The *Rheidae* seem to be a fairly late offshoot, modified in a ratite direction. Of the tinamous, *Tinamus* itself seems the most rhea-like in having a pterygoid very much like that of an immature *Rhea*, being more sigmoid and cylindrical than in the rest of the Tinamidae. Of the rheas, *Pterocnemia* is more like the tinamous than is *Rhea* in that the anterior forks of the prevomer extend anterior to the tip of the parasphenoid.

Casuariiform line: In those characters in which *Dromaeus* differs from *Casuarius*, such as separation of pterygoid and palatine, keeling of the parasphenoid, etc., it seems to depart more from the usual avian pattern and appears to be more specialized. Although the Casuariidae are too specialized to be directly ancestral to the Dromaeidae, they appear to be nearer to the common ancestry than does the emu. This is also borne out by the morphology of the rest of the system, as in the myology of the thigh, the Garrodian formula being ABXY for *Casuarius*, BXY for *Dromaeus*. The exact affinities of the Dromornithidae are uncertain, though possibly more with the emu than with the cassowary.

Apterygiform line: Apteryx, in its false palate, furcate pterygoid, elongate palate and rostrum in which the premaxillary fails to reach the prevomer, etc., seems more specialized than the Dinornithidae, and probably represents a diminutive, helminthophagous modification of that group. On the basis of shape of beak, presence of hallux, and shape of sternum, *Anomalapteryx* seems the moa nearest to the Apterygidae. Without more information on the palate of the Aepyornithidae I hesitate to make any statement concerning their affinities. It is with some doubt that I include the family in this group.

Struthioniform line: Only one family is referred here.

VIII. SYSTEMATIC CONCLUSIONS

As will appear from the account above, all theories concerning the affinities of these birds seem largely conjectural. On morphological grounds alone we can say merely that the Palaeognathae cannot be defined, but that there are four main lines. What the affinities of these lines are to one another and to the Neognathae we cannot definitely know until fossil evidence is unearthed. We may make certain systematic conclusions, however. Whether we consider the 'palaeognaths' as reversals from a neognath stock or stocks, or whether we consider them as truly primitive birds, the evidence for considering them closely related seems inadequate, and rather speaks against such affinity. Therefore, until other evidence for close phylogenetic relationship is produced, it seems best to the author that the 'superorder Palaeognathae' of present definition be dropped from classifications of birds. We have a choice, I believe, between either dropping all superordinal classification of the Neornithes (except possibly the Odontognathae) or making the four 'palaeognathous' lines here defined each a superorder, co-ranking with the Neognathae. Since there is a definite possibility, however, that these lines may have arisen from the Neognathae, it seems to the author that a definite violation of truth might be committed by the latter procedure, while a needless complication of classification seems almost certain. It seems best, therefore, that the first method be applied, and the orders of birds hitherto placed in a superorder Palaeognathae be placed in the Neornithes without separation from the birds hitherto called 'Neognathae.'

It would also seem wise to simplify the classification of this group by the merging of certain orders which seem, on the basis of palatal pattern, to be closely related. Thus:

Order Tinamiformes to include the Rheidae in addition to the tinamous, thus eliminating the order 'Rheiformes' from the list.

Order Apterygiformes to include the Apterygidae, Dinornithidae, and (tentatively) the Aepyornithidae, thus eliminating from the list the orders Dinornithiformes and Aepyornithiformes.

Orders Casuariiformes and Struthioniformes to stand as at present.

Family Eremopezidae to be considered as *familia incertae sedis*.

SUMMARY

1. The history of classification of the Palaeognathae is briefly outlined.

2. The palates (where known) of the Palaeognathae are described, and those of the living forms figured.

3. It is shown that the 'palaeognathous' palate is not susceptible to definition.

4. It is further shown that the so-called 'palaeognathous' type of palate includes four distinct morphological types.

5. Possible explanations of this diversity are considered, particularly those of neotenic and adaptive reversal.

6. It is concluded that the superorders Palaeognathae and Neognathae should be merged, and that the orders Rheiformes and Tinamiformes be combined, the orders Apterygiformes, Dinornithiformes, and Aepyornithiformes likewise combined, and the Struthioniformes and Casuariiformes be allowed to stand as before, thus reducing the 'palaeognathous' assemblage to four orders, each one equivalent to one of the four morphological palatal types here distinguished.

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NOTES ON TWO SPECIES OF CALLIPHORIDAE (DIPTERA) PARASITIZING NESTLING BIRDS

BY JOHN L. GEORGE AND ROBERT T. MITCHELL

IN the course of studies on the effect of feeding DDT-killed insect larvae to nestling birds, some incidental information was gathered on Calliphorid parasites of the nestlings. The work was done at Lake Clear Junction, N. Y., during June and July, 1946.

The authors are indebted to Mr. Phillip Dowden, Division of Forest Insects, Bureau of Entomology and Plant Quarantine, who reared the flies, and also to Mr. Curtis Sabrosky of the United States National Museum and Mr. David Hall for their determinations of the adult specimens.

Larvae of *Apaulina metallica* (Townsend) were found feeding on nestlings in one nest, each, of Hermit Thrush, Chipping Sparrow, Song Sparrow and Redstart. The larvae were present in moderate numbers, varying from two to six per nest, except in the case of the Redstart, in which thirty maggots were found.

The single nestling in the Redstart nest was, on July 5, an active and apparently healthy bird that, as is normal, readily consumed the

equivalent of its body weight of insect larvae. On July 6, the nestling became weaker, consumed only 47 per cent of its weight in food, and died July 7. The numerous maggots found feeding on this one nestling were believed to have been the direct cause of its death.

All of the maggots of *A. metallica* (Tns.) were strictly external parasites; none were observed beneath the skin. In general they confined their feeding to the naked abdomen of the nestlings, but a few were found in the ear cavities and feather tracts. Any disturbance of the nest would send the larvae scurrying to shelter, and often the only manner of detecting their presence was by examination of the nest material.

The larva of *Apaulina metallica* (Townsend) closely resembles that of *Protocalliphora azurea* (Fallen), as illustrated by Coutant (1915)[1]. A striking difference is the presence of a crowded row of long curved spines encircling the middle of the second segment. Undoubtedly these curved spines, together with the general spiny natureof the maggot, enable it to cling more tenaciously while feeding. Nine larvae were reared to the adult stage, the adults emerging August 8 to 10.

This same species has been reported by Plath (1919) as occurring in the nest of a Western Robin in the Puget Sound area and by Neff (1945) from nests of the Mockingbird, California Shrike, Western Kingbird, and English Sparrow in the San Joaquin Valley, California.

Larvae of *Apaulina hirudo* (Shannon and Dobroscky) were discovered July 26 on Chipping Sparrow nestlings, probably the second brood from parents that nested near by during June. Four nestlings fluttered from the nest on discovery, but three were caught for banding. Although the feather development of the nestlings appeared normal, the birds were lighter in weight and more sluggish than might be normally expected. The average weight of the three nestlings was 10.48 grams as compared to 11.26 grams of three Chipping Sparrow nestlings caught under similar circumstances June 23.

The nestlings were infested with twelve maggots of *Apaulina hirudo* (Shannon & Dobr.). One of the young birds had only two maggots. It was the heaviest and most active of the three. A large maggot was removed from the right side of the body and another from the bend of the right wing between the secondaries and primaries. After these maggots were removed, the nestling was banded and released.

The remaining two nestlings were taken to the laboratory for observation. One of these died seven hours later. The bird was feeding quietly and had just accepted three sawfly larvae when it lost muscular

[1] According to Dobroscky, the larva illustrated by Coutant is *avium* instead of *azurea*. (*See* Hall, 1948, p. 189.)

control and flopped over on its back in a nervous spasm, its wings extended and fluttering, its legs twitching violently. When returned to a normal position, it lost strength rapidly and within a few minutes from the start of its spasm the bird was dead. Almost immediately after its death, five maggots, which had been completely embedded beneath the skin of the bird, began to leave its body. The maggots had embedded themselves in the following places: one beneath the skin of the right ventral side of the abdomen just posterior to the "knee"; another on the left ventral thoracic wall at the base of the neck; a third across the dorsal surface of the radius with the exit of the pouch along the posterior edge of the right wing at the mid-point of the radius and extending distad to the wrist; a fourth along the ventral mid-line of the body just anterior to the anus; and the fifth along the dorsal mid-line of the body just anterior to the oil gland. There was no evidence to indicate the maggots had directly damaged any of the muscle tissue. All of their sac-like burrows were just beneath the dermal surface. Feather development immediately above the burrows was retarded. It is possible that the maggot at the base of the neck caused a physical obstruction of the trachea when the bird was feeding. The burrow of this maggot began at the base of the neck in the left thoracic wall and crossed over to the right side as it continued craniad up the ventral side of the neck. The bulk of the larva exerted pressure on the vertebral column, trachea, and oesophagus. It is likely that when the nestling was eating the sawfly larvae, the oesophagus was distended enough to completely obstruct the trachea, with suffocation resulting.

The third nestling did not feed readily in the laboratory but lived for twenty-four hours after discovery. It was the condition of this individual that aroused our initial interest in the parasites since immediately upon its capture a curious swelling was noticed across its forehead and crown. A large maggot had entered the bird's left naris and was living completely hidden beneath the skin of the head. It could be seen externally only through the enlarged nares. In addition this nestling had four other maggots imbedded within it. Two were in a cavity in the right wing which lay just beneath the skin and ran the entire length of the radius and dorsal to it. Two openings from this cavity open posteriorly just above the secondaries. A third maggot had a burrow in the left ventral abdominal wall at the level of the posterior edge of the sternum. The fourth had a burrow in the left ventral abdominal wall just lateral to the anus. There was no evidence of any direct damage to the muscle tissue.

The larva of *Apaulina hirudo* (Shannon & Dobr.) differs decidedly from that of *Apaulina metallica* (Townsend), being more robust,

thicker-skinned, and spineless. It is interesting to note that when the larvae of *hirudo* were removed by forceps, a large drop of blood always oozed to the opening of the lesion, and these openings were typically moist, with the feathers about the opening heavily matted with a sticky substance. Six larvae were reared to the adult stage, the adults emerging August 14 and 15.

Only one reference in the literature is known to the authors on subcutaneous parasitism by Calliphorid flies. At Seattle, Washington, Plath (1919) found three larvae in the head of a nestling Willow Goldfinch. The feathers in the infested areas were erect, and the bird was observed frequently scratching its head. The larvae were extracted but were not reared. Sargent (1938), upon describing the habits of the larvae of *Protocalliphora splendida sialis* Shan. & Dob. on various hawks at Ithaca, N. Y., states that they appeared to occur under the skin, but investigation proved the apparent skin surface to be an incrustation of down, blood, and fecal waste caused by maggots and that the skin was not pierced.

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OBSERVATIONS ON POPULATIONS OF NORTH PACIFIC PELAGIC BIRDS

BY LEE W. ARNOLD

DURING 1943, while serving on escort duty in the U. S. Navy, the writer became interested in the relative population densities of pelagic birds. Not until the period from June 8 to September 16, 1944, was it practicable to conduct and record the results of systematized random sample censusing which would tend to give a true picture of a given broad area of ocean expanse. The results of these counts are best presented in tabular form (Tables 1, 2 and Text-figure 1).

The censusing was done over an area from 30 miles west of Cape Spencer on the continental Alaskan coast to the island of Attu, the most westerly land body of the Aleutian chain (Text-figure 1). This includes an area of some 2,000 lineal miles. Most of the observations were conducted on the oceanic portion of the Aleutian Island National Game Refuge. Included are dissimilar observation periods (Tables 1, 2) from the standpoint of the time of day, weather, and sea condi-

TABLE 1: TIME AND LOCATION OF CENSUS STRIPS

Observation Stations

1.[1] June 8: 6:00–8:00 p. m. 17 miles S. Shumagin Islands.
2. June 9: 5:00–8:00 a. m. 31 miles S. Sanak Islands.
3. June 9: Approx. 1:00–2:30 p. m. Unimak Pass.
4. June 11: 1:00–3:00 p. m. 75 miles N. W. Seguam Is.
5. June 14: 2:00–4:00 p. m. 59 miles N. Kiska Is.
6. June 16: 9:30–10:30 a. m. 3 miles N. Semichi Islands.
7. June 19: 10:00–12:00 a. m. Massacre Bay, Attu Island to 6 miles past sea buoy.
8. June 19: 10:00–12:00 p. m. 46 miles N. N. W. Kiska.
9. June 20: 9:00–12:00 a. m. 47 miles N. W. Semisopochnoi Is.
10. July 1: 7:00–8:00 a. m. 35 miles N. E. Atka Island.
11. July 8: 2 hours (time of day not recorded) 50 miles N. E. Semisopochnoi Is.
12. July 13: 6:00–8:00 a. m. 40 miles N. E. Atka Island.
13. July 13: 6:00–8:00 p. m. 30 miles N. Islands of Four Mountains.
14. July 16: 2:00–4:00 p. m. 10 miles E. Kodiak Island.
15. Aug. 7: 10:00–12:00 a. m. 8 miles E. Kodiak Island.
16. Aug. 9: 6:00–8:00 a. m. 175 miles E. Kodiak.
17. Aug. 10: 6:00–7:30 a. m. 30 miles W. Cape Spencer, Alaskan mainland.
18. Sept. 16: 1:00–4.00 p. m. Akutan Pass.

[1] The numbered observations correspond with those listed in Table 2 and mapped in Text-figure 1.

tions. All observations were made under conditions of 360° visibility from a position some 35 feet above the water. As all counts were conducted when the ship was cruising, a typical two-hour period would probably cover a 20 to 30-mile strip of ocean. Birds were

TEXT-FIGURE 1.—Geographical location of census points. The numbered locations correspond with those listed in Tables 1 and 2.

classified only to the grouping where positive identification was possible under the conditions described. An effort was made not to duplicate records of individuals of the Black-footed Albatross (*Diomedea nigripes*), Fulmar (*Fulmarus glacialis*), and the gull-type birds which were habitual ship-followers. During heavy seas it was entirely possible for smaller water-resting species such as auklets to escape detection. Identifications were made with the aid of W. B. Alexander's book, 'Birds of the Ocean' (G. P. Putnam's Sons, 1928).

Eighteen observation periods were selected as typical. Table 1 lists the positions of the recordings with regard to the nearest land, and also gives the definite time interval covered (Zonal standard war time). The numbers correspond to the census point as illustrated in Text-figure 1. The distance from land would vary but little during an observation period as most of the observations were made when the ship was travelling in a direction paralleling the island chain.

INTERPRETATION OF DATA

Table 2 records the observations according to the species and the time period involved. The column 'Periods Observed' should serve as an indicator of the relative distribution of the species; the totals for each observation period would be an indicator of area distribution of birds in general; and the 'Individual Totals' will give some idea of the relative numbers of individuals of the various species.

These data indicate that the Fulmar, Tufted Puffin (*Lunda cirrhata*), Shearwater (Slender-billed ?) (*Puffinus* sp.), and Black-footed Albatross are the only birds that could be classed as truly universal pelagic birds in the area concerned. Weather, sea conditions, time of day or distance from land appeared to have little to do with distribution of these birds. During periods of high winds and rough water, the Tufted Puffin was the only bird of the four with a decided tendency to 'ride out the storm' on the water rather than remain aloft. Under these conditions the Tufted Puffin, when approached by the ship, would often wait until the vessel was almost upon it and then, through a combination of swimming, flapping its wings and splashing, withdraw a few yards from the path of the vessel and plunge into the wall of water afforded by an oncoming swell.

The Short-tailed Albatross (*Diomedea albatrus*), a shy bird not given to ship-following but easily recognized at a distance, was seen in a somewhat restricted area near the western end of the island chain only. On only one occasion were the Short-tailed Albatross and the Black-footed Albatross observed during the same census period.

Information here presented and other observations would indicate

TABLE 2: SPECIES AND INDIVIDUALS NOTED AND PERIODS OF OBSERVATION

	1	2	3	4	5	6	7
Duration of observations in hours:	2	3	1.5	2	2	1	2
Date of observations:	*June 8*	*June 9*	*June 9*	*June 11*	*June 14*	*June 16*	*June 19*
Fulmar *Fulmarus glacialis*	100	1	38,000	..	2	..	1
Tufted Puffin *Lunda cirrhata*	125	82	1,900	9	1	..	1
Shearwater (Slender-billed?) *Puffinus* sp.	2,000	1,483	160,000	5	21	..	110
Black-footed Albatross *Diomedea nigripes*	8	1	100	7	..	..	..
Fork-tailed Petrel *Oceanodroma furcata*	..	..	..	18	2	..	..
Murre *Uria lomvia*	..	23	..	5	3	..	..
Short-tailed Albatross *Diomedea albatrus*	..	..	..	..	..	1	1
Ancient Murrelet *Synthliboramphus antiquus*	..	3	..	..	..	12	..
Kittiwake *Rissa tridactyla*	..	9	..	..	..	..	..
Auklet (Whiskered or Least) *Aethia* sp.	..	..	..	..	1	2	..
Phalarope *Phalaropodidae*	..	..	..	..	..	..	..
Horned Puffin *Fratercula corniculata*	16	..	..	..	..	..	..
Gull (Glaucous-winged?) *Larus* sp.	..	9	..	..	..	..	3
Cormorant (Pelagic?) *Phalacrocorax* sp.	..	..	..	..	..	..	4
Tern (Aleutian?) *Sterna* sp.	..	..	..	..	..	..	..
White-rumped Petrel *Oceanodroma leucorhoa*	..	..	..	3	..	..	..
Jaeger (Parasitic or Pomarine) *Stercorarius* sp.	..	..	..	..	..	..	..
Totals	2,249	1,611	200,000	47	30	15	120

that the Horned Puffin (*Fratercula corniculata*) is much less truly pelagic in its habits than the dark-colored Tufted Puffin. The latter was observed on the open ocean during even the most severe winter weather.

Although the great concentrations of sea birds in some of the Aleutian passes have been recorded by several observers, it is interesting to note the change in bird population during one day's cruising. On June 9 (Table 2, column 2) one Fulmar, only, was seen during the morning observation period. During the afternoon of the same day, when cruising through Unimak Pass, approximately 38,000 Fulmars

TABLE 2—*Continued*

8	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*		
2	3	1	2	2	2	2	2	2	1.5	3		
June 19	*June 20*	*July 7*	*July 8*	*July 13*	*July 13*	*July 16*	*Aug. 7*	*Aug. 9*	*Aug. 10*	*Sept. 16*	*Periods observed*	*Totals of individual species*
3	7	2	2	3	19	54	11	17	49	..	15	38,271
12	17	24	2	29	7	11	16	..	..	23	15	2,259
6	7	..	..	..	30	72	4	..	71	4,000	13	167,809
..	16	6	7	4	4	5	..	19	5	..	12	182
2	9	4	2	..	..	..	..	19	..	..	7	56
10	..	..	1	2	21	..	..	..	..	..	7	65
5	..	1	..	..	..	..	..	..	..	..	4	8
..	..	..	..	..	12	..	..	..	..	..	3	27
..	1	..	..	..	..	..	..	..	..	30	3	40
..	..	..	..	..	..	..	..	..	..	1	3	4
..	..	..	..	..	20	..	15	..	..	..	2	35
4	..	..	..	..	..	..	..	..	..	..	2	20
..	..	..	..	..	..	..	..	..	..	..	2	12
..	..	..	..	..	..	..	..	..	..	3	2	7
..	..	1	..	..	..	..	..	1	..	..	2	2
..	..	..	..	..	..	..	..	..	..	..	1	3
..	..	..	..	..	1	..	..	..	..	..	1	1
42	57	38	14	38	114	142	46	56	125	4057		208,801

were recorded. The Fulmars and Shearwaters, congregated in this pass, evidently were feeding on a type of reddish orange water life. On occasion when one of the birds was hard-pressed to leave the area in the immediate vicinity of the ship, it would turn its head down and to one side and regurgitate a reddish orange liquid substance. Sometimes this process would be repeated several times before the bird had cast off enough 'ballast' to enable it to fly.

During recent months there have been increasing reports concerning the possible influence of radar and other high-frequency radio waves on birds. When the observations herein recorded were made, the

ship's radar equipment was in continuous operation. At no time did any of the birds observed show modification of behavior which might have been attributed to the presence of pulsating radio waves. In fact, when in tropical waters, Gannets frequently committed nuisance by roosting on the yardarms within a few feet of the radar and other high frequency radio antennae. On a few occasions during exceptionally favorable sea conditions it was possible to track albatrosses and frigate-birds by means of surface radar. The fact that in every case these birds maintained a steady course and speed, even though well within the range of the radar beam, would be indicative of the fact that they were probably unaware of radio waves being reflected from their bodies.

U. S. Fish and Wildlife Service
Wildlife Research Laboratory
Denver, Colorado

NESTING OF THE SPOTTED SANDPIPER AT DETROIT, MICHIGAN

BY J. ROBERT AND JEAN T. MILLER

Plate 15

THIS paper concerns the 1947 nesting of the Spotted Sandpiper (*Actitis macularia*) on Belle Isle, an island in the Detroit River at Detroit, Michigan. The island is about three miles long and about half that wide at its widest point, and is primarily a public park with attractions such as bathing beaches, boat clubs, zoos, picnic grounds, etc. At the eastern end of the island are two narrow peninsulas (approximately a quarter mile long) with a large bay between them. Spotted Sandpipers nest on both of these peninsulas. Approximately the outer two-thirds of the more southern peninsula was utilized for this study.

HABITAT

The study area (Plate 15, figs. 1, 2) consists of 17.6 acres (paced) of dry meadow with a few trees, bounded on three sides by water and on the fourth side by habitat similar to that within the area. About 75% of the study tract was covered with four species of grasses of which blue grass (*Poa pratensis*) was the most common. The remainder was rocky shore with blue grass and sweet clover; 25 to 35-foot American elms with ground beneath covered by blue grass; some

sandbar willow, chicory, and blue grass mixtures; a few wet areas of grass and sandbar willow; and a very small 'pond' with miniature mud flats (the 'pond' drys up in July). The sandy beaches are very narrow. A small garbage dump located in the study area is in daily use, and the shores are daily frequented by fishermen. In the fall of 1946 all the shrubs and trees about the 'pond' were cut. The peninsula was man-made several years ago. The meadow was flat and dry with the exception mentioned above. The elevation is 580 feet.

WEATHER AND COVERAGE

The preceding winter was unusually warm and dry. The spring months were cooler than normal and the rainfall was the heaviest in 75 years. June and July were about normal.

Visits to the tract were made daily, with the exception of four days, from June 4 through June 23, and at approximately weekly intervals from June 23 through July 22.

DENSITY

One pair (nest not found), 39 nests and three families with young were located. All 43 pairs foraged entirely within the study area. This gives a density of 244 breeding pairs per 100 acres. Subtraction of two large blocks of territory from the census area eliminates all the trees, large areas of rocky, weedy beach and the wet meadows. The total area becomes 13.5 acres containing 38 pairs, which gives a density of 272 pairs per 100 acres. Several pairs, however, foraged outside the 13.5 acres.

Other species of birds breeding within the 17.6 acres were: Killdeer (*Charadrius vociferus vociferus*), five pairs; Kingbird (*Tyrannus tyrannus*), one pair; Prairie Horned Lark (*Otocoris alpestris praticola*), one pair; Eastern Meadowlark (*Sturnella magna*), one pair; Cowbird (*Molothrus ater ater*), one pair; Savannah Sparrow (*Passerculus sandwichensis*), five pairs; Song Sparrow (*Melospiza melodia*), ten pairs.

COURTSHIP

In Bent's 'Life Histories of North American Shore Birds' (1929) descriptions of the 'nuptial performance' are similar to that described below but only one bird was active in the performances described and the imitation of incubation was not utilized. In my notes for June 4 appears the following entry. "At 1:10 P. M. two sandpipers were seen engaged in what appeared to be a 'nuptial ceremony.' They approached each other slowly from a separation of about 2½ feet and one bird, throughout, held its wings partially extended and fluttered

them slowly. No vocal accompaniment was noted. One of the same two repeated this 'wing fluttering' performance while the back of the other was turned. The 'non-fluttering' bird flew out of sight closely followed by the 'fluttering' one. Also (at the first 'fluttering' ceremony) they were seen to face one another at a separation of about one foot and both several times snuggle down to the ground as if incubating a clutch of eggs. A similar performance was executed by two other individuals. A third pair flew down within 10 feet of us, and with no preliminaries copulation took place, the male keeping his balance on the female by beating his wings. Copulation was repeated and the pair flew off." In Bent's life history of this species it is stated that a courting individual responding to a whistled imitation of a sandpiper call proved to be a female when collected and dissected.

NESTS AND TERRITORY

According to Forbush (1925) and Tyler (*in* Bent's 'Life Histories,' 1929), Spotted Sandpipers nest either in colonies or as single pairs, and the locations and structures of the nests may vary widely. Of the 39 nests located by the authors 35 (90%) were nestled among thickly growing grasses 6–30 inches tall. Only three were placed in areas covered solely with blue grass, the mixed grasses being preferred. Three were among small growths of unidentified three-foot green plants. One was placed in three-inch grass and was sheltered by a leaning, dead bush three feet tall; and one was placed on the beach among stones beneath a large leaf of a plant resembling burdock. All the nests were well shaded at all times of the day. They were all well-constructed nests and all were neat cups made solely of dead grass stems placed in slight depressions made by the prospective parents (Plate 15, figs. 3, 4). Two nests were located only 12 feet from one another. One of these was destroyed by unknown agency after two eggs had been deposited. The remaining 37 nests were all at least 40 feet apart.

No friction was observed between sandpipers and thus no territorialism was apparent. Most of them fed frequently on the same beaches and appeared to forage wherever they wished. However, no special effort was made to observe territorial behavior. Nelson (1930) found that: "Distinct territory rights have been observed in several cases."

One nest was 12 feet from the nest of a pair of Killdeers. No conflict was noted between the two species and both nests produced full broods. A pair of Killdeers and two pairs of sandpipers for several days had downy young hiding among the weeds on a small

SPOTTED SANDPIPER.—(1) MIXED GRASSES TYPICAL OF THE CENSUS PLOT; (2) THE ONE AREA WITH MUCH ROCKY SHORE AND TREES; (3) A TYPICAL NEST AMONG GRASSES; (4) A TYPICAL NEST AMONG OTHER PLANTS. FOUR CHICKS A FEW HOURS OLD; (5) NEST AT THE SAUCER DEPRESSION STAGE; (6) INCUBATING PARENT "SINGING" FROM NEST.

island (10 square feet) in a small pond. The adult Killdeers were often seen chasing the adult sandpipers but were not persistent about it.

In Bent's life history of the sandpiper (1929) it is stated that invariably a nesting site is deserted if the birds are flushed while in the process of building. Of the six sites from which we flushed birds while they were building, three were deserted the day after discovery. In all six cases a pair of birds was present. Never was more than one bird observed at any of the 37 nests after building was complete.

One of the sites which was not deserted was found June 5 (the birds were flushed from it twice that day) and subsequently observed daily. Blue grass had been removed from among two to three-foot green plants to make a bare spot roughly 4½–5 inches in diameter (Plate 15, fig. 5). This spot had been excavated to resemble a saucer with the depression at the center being about a half inch deep. The following day only one bird was flushed. The nest was then complete; there was the usual cup of dead grass stems except that the center one-third of the excavation remained unlined. One egg rested on the bare ground in the center. The next day the nest was completely lined and contained two eggs. A nest first found when it contained but one egg was complete. Of the four nests first located when they contained two eggs, all were complete.

EGG LAYING

For 37 nests the average number of eggs (complete clutch) per nest was 3.95. Four eggs appeared in each of 33 nests, three eggs in three nests and five eggs in one nest.

For seven nests, one egg was laid daily, and for each of two nests, one day was skipped so that the third egg was deposited a day 'late.' Of the two days on which the third eggs were not laid 'on schedule,' one was rainy throughout and the other succeeded a night during which the temperature had fallen sharply.

For calculating the laying dates for 29 nests not located until a complete clutch had appeared, an incubation period of 21 days was used (*see* incubation period below). For 39 nests the laying dates (date when clutch became complete) ranged from May 25 to June 22, inclusive. For nine nests the date was May 25 to June 3; for 19 nests it was June 4 to June 13; and for 11 nests it was June 14 to June 22. Probably the laying dates are influenced by several factors. These relationships can be determined only by several years' study. However, it could positively be seen that temperature was one of the factors involved. In almost every case the first egg appeared five to seven days after a two or three-day warm 'wave.' First egg dates were

calculated from the hatching date (assuming the incubation period was 21 days) for all (29 nests) except the 10 nests which were found before the sets were complete.

INCUBATION

Forbush (1925) states: "The female often begins to incubate as soon as the first egg is laid, and for this reason some eggs may hatch before the others, but usually the young emerge within the space of two days subsequent to the hatching of the first egg." In 64% of 22 successful nests the young hatched over a period of two or three days. In 36% the young all hatched the same day. At each of the 10 nests observed before the full complement of eggs had been deposited, an adult was apparently incubating. It has been reported for some birds that the last egg of a set is often the first to hatch even though earlier eggs have been incubated previous to the completion of the set.

In the nests in which the young emerged over a period greater than one day, some parents continued to incubate until all the eggs hatched; others did not. No figures are presented for the continuation of incubation, as it is not known what effect our daily observations had on this activity nor which and how many of the eggs were infertile.

Forbush (1925) quotes Knight as giving an incubation period of "about 15 days" and Burns as giving the period to be "15–16 days." In Bent (1929) the incubation period is given as 15 days. (The incubation period of the Common Sandpiper (*Tringa hypoleucos*) of Europe is known to be 21 days.) Nelson (1930) found the incubation period (last egg to first young) to be 21 days in one case and at least 19 days in a second case (Michigan). Mousley (1937) found it to be 21 days for two nests and 20 days for a third nest (last egg to first young). In 1939 he published the figure of 21 days for another nest. Knowles (1942) found incubation periods (last egg to first young) of 20 days and 19½ days for two nests (Regina, Saskatchewan, Canada). For three nests of the sandpipers on Belle Isle the periods (date of last egg to date of first young) were 22 days, 21–22 days, and 20 days. Unfortunately the other nests which were located before the eggs numbered a complete set were destroyed before any young hatched. Other nests which were not located until the full complements of eggs were present but for which the dates of the first young were known, disclosed incubation periods as follows: at least 17 days for one nest; at least 18 days for two nests; at least 19 days for one; at least 20 days for one; at least 21 days for two; and at least 22 days for one. Thus it appears that the incubation period was 20–22 days for Spotted

Sandpipers at Detroit in 1947 and is probably 20–22 days for most individuals of this species.

In Bent's life history of this species it is mentioned that one adult collected by van Rossem had obviously incubated considerably and was found to be a male. Mousley (1937) found only the male incubating each of two nests. Nelson (1930) found that: "Incubation and brooding are both done by the male bird alone. Six records of adults collected either on the nest or with downy young, support this assertion. In no case was there another adult present."

'SINGING' FROM THE NEST

Since I have been unable to find in the literature any record of 'singing' from the nest by Spotted Sandpipers, my notes of our observations on this interesting behavior are quoted in full. "On June 4 one nest was found at 2:45 P. M. when the unseen incubating bird flushed when we were about five or six feet away. We remained at this nest until 5:00 P. M. observing the incubating bird and taking photographs. This nest is a typical one (Plate 15, fig. 3) placed in a large meadow of one to two-foot grasses. We used no blind. A parent first returned to incubate while we were sitting immobile 15 feet away. Time—3 P. M. We had waited 15 minutes for its arrival. It quickly settled on the four large, tan eggs. [Later, we figured from the date of hatching that the clutch was probably just completed that morning.] Its bill was kept open (it was in full sun, as we had removed the protective grasses from one side of the nest to permit photography). The neck pulsed very rapidly. Fright or heat? It bobbed its head frequently and when changing position usually rotated a quarter circle. It seemed unaware of our presence, often facing directly away from us. It changed positions regularly once a minute from 3:00 to 3:20. Called *peet weet weet weet weet* both softly and loudly a total of four times while still incubating. The calls in every case followed similar calls from distant birds. Subsequently it often called fully from within a six-foot radius of the nest. Position changes —3:21, 3:22. I moved to within five feet of the nest and lay motionless on my stomach. Returned to incubate—3:25. Only two position changes from 3:25 to 3:36. 3:47—it spontaneously walked calmly off 3½ feet from the nest, called, teetered deliberately a few times and took wing. I remained motionless and at 4:03 an adult returned to incubate. Henceforth, the beak was always closed, no rapid pulsations in neck, no changes of position, and very calm and quiet. A different individual or the same one as before but no longer frightened or hot? Had the 'singing' been a signal for a change of 'shifts' at incubation?

4:09—flew when I attempted to cock camera shutter. 4:15—back again. Always after the bird had left the nest it returned slowly by varied and circuitous routes through the tall grass, with occasional soft, low calls that were variations of the common *peet weet* call. Three times it called from the nest again in apparent 'answer' to another individual. The call used these times was the *toot-a-wee* call (Plate 15, fig. 6). 5:00 P. M.—we left the nest."

At several other nests a bird was heard giving soft, low variations of the *peet weet* as it approached the nest through the grass. Later, individuals on two other nests were observed giving a full *peet weet* call while incubating. One nest had contained a complete set of eggs for five days, the other nest for eight days. Injury-feigning was never observed at either of the first two nests at which 'singing' from the nest was noted. Each raised two young to leave the nest. A full injury-feigning performance was observed three times at the third nest where 'singing' had been noted, and four young left the nest.

DISTRACTION DISPLAYS

Three types of distraction displays were commonly used. The first consisted of a rapid running away from the vicinity of the young. If we followed the bird only a few feet and then stopped, it returned closer to us and repeated the maneuver. This was used most commonly when the young were hiding in the grass but occasionally when they were still in the nest.

The second type was used only when we approached the young so closely as to be almost able to pick them up. Then an adult often fluttered erratically on the wing about us, just out of arm's reach, and continually called *peet peet, peet peet* in a very alarmed manner. This behavior was not exhibited by all the parents, possibly by about 50%.

The third distraction display was the injury-feigning so frequently exhibited by many species. In the Spotted Sandpiper this consists of an apparently helpless fluttering over the ground with wings partially extended and tail fully spread and dragging the ground. A most piteous cry is given throughout. One example of injury-feigning differed from all the rest. It was very similar to that seen in the Killdeer. The parent spread its wings fully and waved them, and rolled from side to side on the ground. The tail was not spread and there was no vocalization.

For one nest observed nearly daily, Mousley (1939) noted the occurrence of only one injury-feigning display during incubation and reported it as being given on each of the two days the young were in

the nest. Knowles (1942) states that for one nest no injury-feigning was given for the period from the laying of the first egg to the completion of the set of four. Observations were made again on the 15th day after the completion of the set, when a complete act was observed, and on the 20th day when a complete act was seen shortly before the first young hatched. At another nest he observed that the injury-feigning reached a peak about five days before the first egg hatched. Nice (1943) says: "The intensity of the reaction [distraction display] typically increases during the nesting cycle. Some birds, as mourning doves (Nice, 1922–23), and shore birds may show it with eggs, especially well-incubated eggs. With many birds, both precocial and altricial, it is at its height when the young are leaving the nest."

Each day we visited the census area we briefly inspected each nest. The nests were usually approached from the same directions each time. As soon as a bird flushed from a nest we stood still. Different nests were visited widely differing numbers of times, depending upon the stage of incubation at which they were when first found. Considering the group as a whole, the complete injury-feigning behavior, as described above, was noted on every day of the incubation period from the date of the deposition of the second egg to the completion of incubation. Our observations on 35 nests clearly indicated that for these particular birds no correlation existed between injury-feigning and the extent to which incubation had progressed. Some birds never gave the display during the whole of their breeding cycles; others gave it as often as five days out of nine during incubation. However, it was obvious that there was a marked increase in the number of displays after the first egg had hatched and that this peak continued until the young left the nest (two to three days). On three occasions this type of distraction display was seen in parents that were caring for young several days old. Once it was observed in a parent whose young had nearly complete juvenal plumage and were capable of flying three or four feet.

There appeared to be no correlation between injury-feigning and nesting success.

VOICE

The vocalizations of the Spotted Sandpiper have been well described by Saunders in Bent's life history of the species. Our observations fully agreed with his statements. However, mention might be made of the following, which I have not found described in the literature. The location call of both the chicks and the adults is *peet peet*. With the chicks it is a very thin, tiny, babyish sort of a call. With the

adults it merely differs in inflection from their alarm call. This call in young which are just beginning to fly (about 14–15 days old) resembles that of the one-day chick more than that of the adult.

THE CHICKS

The downy young left their nests at any time from the drying of the last hatched chick to three days later. None remained in the nest longer than this.

In every case the egg shells were removed very shortly after the hatching of a chick. It was not observed whether they were simply carried off or were eaten or both.

In general the sandpiper family remained within a few hundred feet of the nest until the young were able to fly. They 'preferred' to remain on the higher, grassy parts of the peninsula until able to fly, when they began to frequent the beaches.

NESTING SUCCESS

In 37 nests there were deposited 146 eggs, with an average of 3.95 eggs per nest. From 119 eggs (30 nests) there hatched 77 young (64.7%) of which 74 (96.0%) left the nest. The average number of young leaving the nest was 2.3 per nest (32 nests). A nest was considered to be successful if at least one chick left the nest. Of 35 nests 25 (71.5%) were successful. For seven other nests no young were seen in the nests, but the success could be judged from the behavior of adults near these nests. If these seven nests are added, the successful nests were 31 (73.7%) of a total of 42 nests. The average number of eggs per successful nest was 3.96 (22 nests). The average number of young leaving the nest was 3.4 per successful nest (22 nests). Thirteen nests produced four young each, five nests three young each, three nests two each, and one nest produced only one.

Possible enemies known to be present regularly were: Crow (*Corvus brachyrhynchos*), Starling (*Sturnus v. vulgaris*), Bronzed Grackle (*Quiscalus quiscula versicolor*), Cowbird (*Molothrus a. ater*), Herring Gull (*Larus argentatus*), Common Tern (*Sterna hirundo hirundo*), and man (often children were present in the area). Possible enemies seen in the area rarely were dogs and Blue Jays (*Cyanocitta cristata*). No rats were seen about the garbage dump. No nest was deserted unless one or more eggs had been broken or stolen. All nests not having one or more eggs broken or stolen were successful. Two of the young which died before leaving the nest were apparently drowned in a hard rain and the third was stepped upon by a child. One nest was known to have been destroyed by a bird and four nests were known to have

been destroyed by man. The other failures were due to unknown agencies.

SUMMARY

1. A short study of the 1947 nesting of 43 pairs of Spotted Sandpipers on 17.6 acres of dry meadow on Belle Isle in the Detroit River at Detroit, Michigan, is described. The density of breeding pairs was 244 per 100 acres.

2. Information is presented on the nuptial performance, nest location and construction, territorialism, egg laying and hatching, incubation period, 'singing' from the nest, and distraction displays.

3. Of 35 nests, 25 (71.5%) were successful. For 37 nests, the total number of eggs was 146 (3.95 eggs per nest). For 32 nests, 74 young left the nests (2.3 per nest).

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LOUIS JEAN PIERRE VIEILLOT (1748–1831)

BY PAUL H. OEHSER

Plate 16

THIS year, 1948, marks the 200th anniversary of the birth of Louis Jean Pierre Vieillot, the French naturalist whose name will always be associated with early American ornithology. In comparison with other birdmen of his day, such as Alexander Wilson and John James Audubon, little is known of his life. He left no journals or detailed accounts of his voyages; and his death, which probably occurred in 1831, passed almost unnoticed by his contemporaries. One obituary note, by Lesson, appeared in a scientific journal. At the end of his old age, blind and poverty-stricken, he was all but forgotten. It is indeed a curious fact, as Dr. Berlioz of the Paris Museum writes (*in litt.*), "that this man, who left after his death such a large amount of printed work, remains so mysterious as to any personal figuration and even private life. His bitter debates with Temminck on technical subjects seem to indicate perhaps but little sociability."

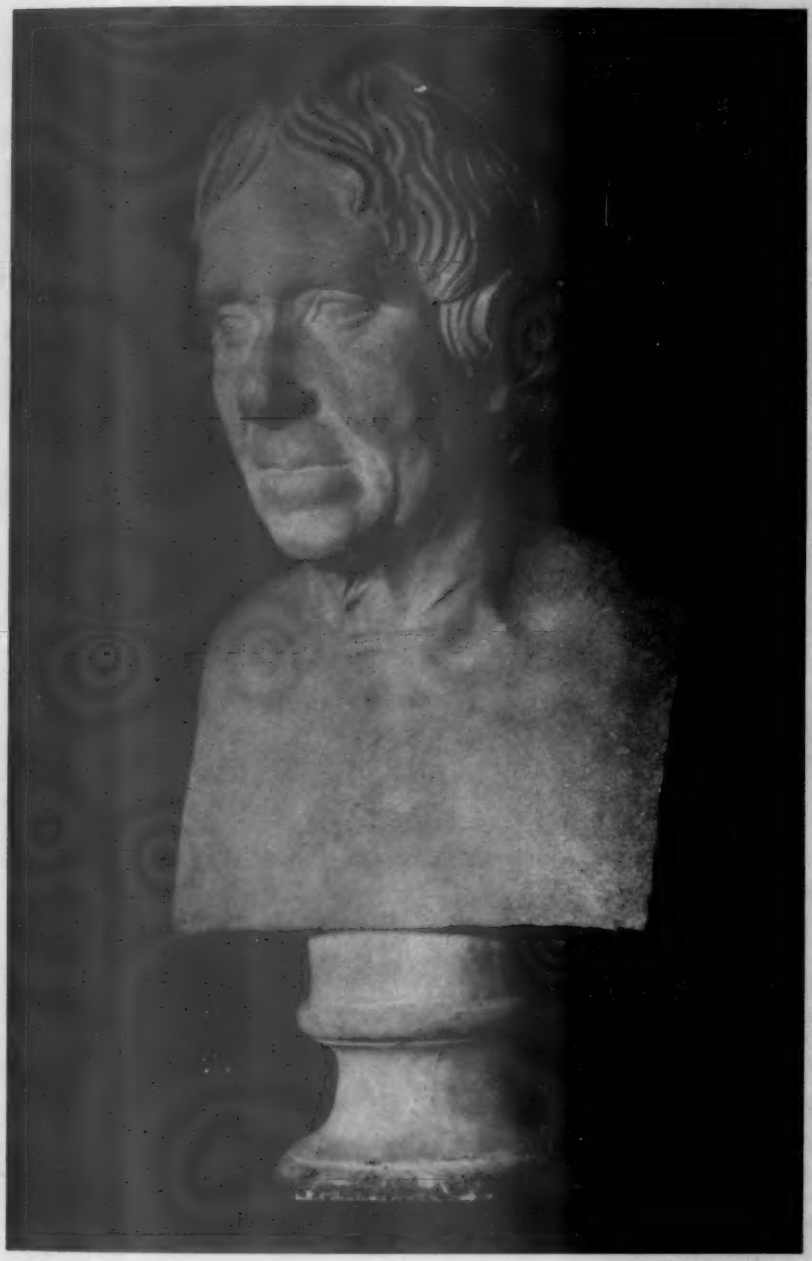
Vieillot did, however, produce works that were to make him, ornithologically at least, immortal, even though they may have possessed all the shortcomings that his critics pointed out. Master taxonomist, his name is linked with some of our best-known North American birds, such as the Wild Turkey, the Pintail, the Cedar Waxwing, and the Scarlet Tanager, for it was he who first gave them the Latin names by which they are known to science. In all, 26 genera and 32 species of North American birds now bear Vieillot's name as the original describer, and from South America the number is much greater. He studied and collected birds during his sojourn on the island we now call Hispaniola, and, as Wetmore and Swales have pointed out (U. S. Nat. Mus. Bull. 155), he was "the first naturalist to name in modern scientific form a species (*Accipiter striatus*) that he had taken personally on the island." Listed below are the North American birds first named by Vieillot, and it will be noticed that a number of his names still stand as he gave them, having miraculously run the gantlet of several generations of taxonomists.

NORTH AMERICAN BIRDS DESCRIBED BY VIEILLOT

(1931 A. O. U. Check-List and Supplements)

GENERA

Elanoides (Kites)
Ictinia (Kites)
Asturina (Hawks)
Prunella (Accentors)
Bombycilla (Waxwings)
Vireo (Vireos)



LOUIS JEAN PIERRE VIEILLOT (1748–1831)
FROM A BUST IN THE DIVISION OF BIRDS, PARIS MUSEUM
(*Courtesy Dr. J. Berlioz*)

Polyborus (Caracaras)
Tinnunculus (Falcons) (now treated as a subgenus)
Aramus (Limpkins)
Porzana (Rails)
Erolia (Sandpipers)
Steganopus (Phalaropes)
Coccyzus (Cuckoos)
Troglodytes (Wrens)
Thryothorus (Wrens)
Oenanthe (Wheatears)
Coereba (Honeycreepers)
Mniotilta (Warblers)
Icteria (Chats)
Sturnella (Meadowlarks)
Agelaius (Red-wings)
Quiscalus (Grackles)
Piranga (Tanagers)
Passerina (Buntings)
Pinicola (Grosbeaks)
Pipilo (Towhees)

SPECIES

Vieillot's name	Present A. O. U. name
Procellaria leucorhoa	*Oceanodroma leucorhoa leucorhoa:* Leach's Petrel
Anas tzitzihoa	*Anas acuta tzitzihoa:* American Pintail
Anas cyanoptera	*Anas cyanoptera cyanoptera:* Cinnamon Teal
Sparvius platypterus	*Buteo platypterus platypterus:* Broad-winged Hawk
Buteo brachyurus	*Buteo brachyurus:* Short-tailed Hawk
Meleagris silvestris	*Meleagris gallopavo silvestris:* Eastern Turkey
Rallus limicola	*Rallus limicola limicola:* Virginia Rail
Totanus brevipes	*Heteroscelus brevipes:* Polynesian Tattler
Tringa melanotos	*Pisobia melanotos:* Pectoral Sandpiper
Tringa fuscicollis	*Pisobia fuscicollis:* White-rumped Sandpiper
Tringa minutilla	*Pisobia minutilla:* Least Sandpiper
Scolopax sakhalina	*Pelidna alpina sakhalina:* Red-backed Sandpiper
Tringa subruficollis	*Tryngites subruficollis:* Buff-breasted Sandpiper
Steganopus tricolor	*Steganopus tricolor:* Wilson's Phalarope
Stercorarius longicaudus	*Stercorarius longicaudus:* Long-tailed Jaeger
Larus leucopterus	*Larus leucopterus leucopterus:* Iceland Gull
Trochilus leucotis	*Hylocharis leucotis leucotis:* White-eared Hummingbird
Picus borealis	*Dendrocopos borealis borealis:* Red-cockaded Woodpecker
Platyrhynchos virescens	*Empidonax virescens:* Acadian Flycatcher
Hirundo bicolor	*Iridoprocne bicolor:* Tree Swallow
Hirundo pyrrhonota	*Petrochelidon pyrrhonota pyrrhonota:* Northern Cliff Swallow
Troglodytes aëdon	*Troglodytes aëdon aëdon:* Eastern House Wren
Troglodytes hiemalis	*Troglodytes troglodytes hiemalis:* Eastern Winter Wren
Bombycilla cedrorum	*Bombycilla cedrorum:* Cedar Waxwing
Lanius borealis	*Lanius excubitor borealis:* Northern Shrike
Vireo flavifrons	*Vireo flavifrons:* Yellow-throated Vireo
Muscicapa gilva	*Vireo gilvus gilvus:* Eastern Warbling Vireo
Sylvia discolor	*Dendroica discolor discolor:* Northern Prairie Warbler
Turdus motacilla	*Seiurus motacilla:* Louisiana Water-thrush
Quiscalus major	*Cassidix mexicanus major:* Boat-tailed Grackle
Quiscalus versicolor	*Quiscalus quiscula versicolor:* Bronzed Grackle
Pyranga erythromelas	*Piranga erythromelas:* Scarlet Tanager

The biographical accounts of Vieillot are so few in number and so scattered that it may be of some value to bring them all together; and since they are all brief, I have thought it of more interest and use to

ornithologists to reprint them, even with some duplication, than to combine them into a single account. Together they give us virtually all that is on record concerning Vieillot's life. All the accounts, of course, except Swainson's and Saunders's, are here translated from the French.

M. Marcel Boubier, in his 'L'Evolution de l'Ornithologie' (Paris, 1925), remarks that Vieillot "n'a pas eu l'honneur, qu'il eût bien mérité cependant, d'avoir sa place marquée dans les dictionnaires et les encyclopédies." This was, and is, all too true. No modern dictionary of biography or encyclopedia that I have been able to find contains any account of him. During his lifetime, however, there were two very brief notices. The first is contained in a biographical account of Vieillot's friend Jean Baptiste Audebert in the 'Biographie Universelle' (3: 22). Audebert, eminent naturalist and artist, had died in 1800, leaving unfinished his great atlas "des grimpereaux et des oiseaux de paradis." The account merely tells that the editor, M. Desray, brought the work to completion, making use of Audebert's materials and of the special drawing and coloring process that Audebert had invented and used, and that the text had been written by Vieillot, and "c'est sur le même plan et d'après les mêmes procédés que M. Vieillot a publié: *Histoire des Oiseaux de l'Amérique septentrionale, qui fait suite.*" Eight years later, in 1819, there appeared a slightly fuller account of Vieillot's work in the 'Biographie des Hommes Vivants' (5: 506):

FROM 'BIOGRAPHIE DES HOMMES VIVANTS,' VOL. 5, 1819

"VIEILLOT (Louis-Pierre), naturalist, born at Yvetot, May 10, 1748, has published: I. *Histoire naturelle des oiseaux de Paradis, des Promerops et des Grimpereaux sucriers*, with paintings from nature by Audebert and C. Sauvages, 1801 and years following, 32 livraisons, folio (see *Biographie universelle* under AUDEBERT). II. *Histoire naturelle des plus beaux oiseaux chanteurs de la zone torride*, 1806 and following, 12 livraisons, folio. III. *Histoire naturelle des oiseaux de l'Amérique septentrionale*, 1808 and following, 22 livraisons. These works are illustrated with many beautiful engravings, which by a special process, render with great accuracy the metallic reflections of these exotic birds. IV. *Analyse d'une nouvelle ornithologie élémentaire*, 1816, octavo. M. Vieillot has revised and applied it in the ornithological part (with which he is charged) for the *Nouveau Dictionnaire d'histoire naturelle*. He has made, at his own expense, many voyages to the French colonies and to the United States in the interests of the natural sciences."

In June, 1831, the year of Vieillot's death, an obituary notice by Lesson appeared in the 'Bulletin des Sciences Naturelles' (25: 365–366). This was the first account to record any appreciable amount of biographical information concerning Vieillot or any estimate of the man:

LESSON'S NECROLOGICAL NOTE, 1831

"M. Vieillot, dean of ornithologists, died at Rouen. This industrious author found himself at the end of his days on the brink of poverty, and all his life he felt the effects of the misfortunes that came upon him at the time of the revolution in Saint Domingue, where he had established himself and where he was engaged in business. It was there that he acquired a taste for natural history; and when the color of the skin became a mark of proscription, M. Vieillot, having fled to the United States, threw himself wholeheartedly into the study of the birds that inhabited that country and which furnished useful distractions from the misfortunes that had plunged him and his family into distress. It was to this sojourn in the United States that we owe his book on the natural history of the birds of South America, an inaccurate and very incomplete work; but one can imagine that M. Vieillot did not find himself in circumstances conducive to a very high degree of perfection. On his return to France, a small post as a writer, which M. Dumont of St. Croix created for him in the office of the *Bulletin des Lois* which Dumont directed, enabled him to live modestly but assured him the means to indulge his tastes. He had already published with Audebert, who had just died, the *Oiseaux dorés*. M. Vieillot, who was fond of raising in cages finches from different countries, soon followed this work with *Oiseaux chanteurs*, without doubt one of his best works and lavishly illustrated. The natural-history dictionary of Déterville shortly gave him an opportunity to present a new system of classification of birds, and he wrote ornithological articles for this which later he combined in the three volumes of the *Encyclopédie méthodique*, of which he completed the part devoted to the natural history of winged animals. In the quarto work entitled *Galerie du Muséum*, M. Vieillot described a prodigious number of genera, accompanied by exact and valuable illustrations. This book is well known and is worthy of its reputation. Unfortunately M. Vieillot could not afford to own fundamental reference works, and he would often describe under new names genera already named by others. But in this matter it would be unfair to blame an author who loved science with such passion and who would often deprive himself of necessities in order to devote himself to his chosen work. In his last years he became blind, adding this misfortune to his already sad condition, although, thanks (they say) to the recommendations of influential people, he received a modest pension as a man of letters, which he was able to enjoy only a year.

"His perseverance in his work amid the vexations arising from so many of this world's intrigues may be called genius, for genius in a scholar consists of patience unrebuffed by baser passions and their machinations."

In 1840 the British ornithologist William Swainson published 'A Bibliography of Zoology; with Biographical Sketches of the Principal Authors' (*in* Lardner's 'Cabinet Cyclopaedia'); but in this we find no biographical sketch of Vieillot, merely a statement (pp. 364–365) that he was "an eminent reformer of systematic ornithology, and an indefatigable writer," followed by a list of Vieillot's works under seven headings. This list is of interest because of Swainson's critical comments:

FROM SWAINSON'S BIBLIOGRAPHY, 1840

"1. *Oiseaux Chanteurs* de la Zone Torride, Histoire Naturelle de plus beaux. 1 vol. fol. Paris, 1805.

"2. *Oiseaux de l'Amérique Septentrionale*, Histoire Naturelle des. Paris, 1807. folio. Only two volumes of this work have appeared. It contains many valuable observations.

"3. *Oiseaux Dorés*, Histoire Naturelle des Colibris, Oiseaux Mouches, Jacamars, et Promerops, aussi des Grimpereaux, et des Oiseaux des Paradis. Paris, 1822. This magnificent work owes its chief scientific value to the descriptive portion, which is from the pen of M. Vieillot. The plates are executed by M. Audebert, and, although tolerably accurate, are not very good.

"4. *Analyse d'une nouvelle Ornithologie Elémentaire.* Paris, 1816. 8vo. It is generally believed that this pamphlet was written and published to anticipate the labours of Cuvier in this department; it certainly bears evident marks of haste.[1] The genera are intimated with great brevity, and often so imperfectly, that they could not be understood but for the type or example which is quoted for each.

"5. *Ornithologie Francaise*, ou Histore Naturelle, générale et particulière, des Oiseaux de France. Paris, 1823. 4to. Published in numbers, each containing six coloured plates.

"6. *Galerie des Oiseaux* du Cabinet d'Histoire Naturelle du Jardin du Roi. Paris, 1821–26. 4to. The figures designed by M. Paul Oudart: completed, we believe, in 80 numbers. This publication owed its origin, also, to the Planches Coloriées of M. Temminck, to which it is superior in the descriptions, but very inferior as to the execution of the plates.[2]

"7. *Histoire Naturelle des Mammifères.* Paris, 1819–22. folio. Each number contains six coloured plates."

Under the editorship of the British ornithologist, Howard Saunders, the Willughby Society in 1883 reprinted Vieillot's 'Analyse d'une Nouvelle Ornithologie Eléméntaire,' which had long been out of print and a rare item. This reprint was prefaced by a biographical note on Vieillot, but it is clear that nothing new had turned up in the nearly half-century since Swainson's account:

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[1] Alfred Newton ('Dictionary of Birds': 29, footnote, 1893) elucidates this point: "The method [of classification] was communicated to the Turin Academy, 10th January 1814, and was ordered to be printed (Mém. Ac. Sc. Turin, 1813–14, p. xxviii.); but, through the derangements of that stormy period, the order was never carried out (Mém. Accad. Sc. Turin, xxiii. p. xcvii.). The minute-book of the Linnean Society of London shews that his *Prelusio* was read at meetings of that Society between 15th November 1814 and 21st February 1815. Why it was not at once accepted is not told, but the entry respecting it, which must be of a much later date, in the "Register of Papers" is "Published already." It is due to Vieillot to mention these facts, as he has been accused of publishing his method in haste to anticipate some of Cuvier's views, but he might well complain of the delay in London. Some reparation has been made to his memory by the reprinting of his *Analyse* by the Willughby Society."

[2] An interesting note regarding this work appears in the Introduction to Newton's 'Dictionary of Birds' (1893): "The original project was apparently to give a figure and description of every species of Bird; but this was soon found to be impossible; and, when six parts had been issued, with text by some unnamed author, the scheme was brought within practicable limits, and the writing of the letter-press was entrusted to Vieillot, who, proceeding on a systematic plan, performed his task very creditably, completing his work, which forms two quarto volumes, in 1825 . . . It is a tradition that, this work not being favorably regarded by the authorities of the Paris Museum, its draughtsman and author were refused closer access to the specimens required, and had to draw and describe them through the glass as they stood on the shelves of the cases."

PREFACE FROM WILLUGHBY SOCIETY REPRINT OF VIEILLOT'S 'ANALYSE . . .', 1883

"Louis-Pierre (or Louis Jean Pierre) Vieillot, was born, say his biographers, at Yvetôt on the 10th May, 1748. In early life he was in business in the island of St. Domingo, where he acquired his tastes for natural history. Proscribed during the Revolution, he took refuge in the United States, where he amassed material for his work 'Les Oiseaux de l'Amérique septentrionale,' published in 1808. Some years before that date, however, he had returned to France, and had obtained a small post in the Bureaux du Bulletin des Lois. In conjunction with his friend Jean-Baptiste Audebert he undertook the production of the descriptive portion of that costly work (only 200 copies of which were issued), the 'Histoire naturelle des Colibris, Oiseaux-mouches, Jacamars et Promérops,' published in the year 1802. In 1805 Vieillot commenced the publication, in twelve parts, of the 'Histoire naturelle des plus beaux oiseaux chanteurs de la zône torride.' In these works, gilding was largely employed in the plates. These expensive folios were followed by the 'Histoire Naturelle des Oiseaux de l'Amérique septentrionale' (1807). In 1816 he produced the present 'Analyse d'une nouvelle Ornithologie élémentaire,' the main features of which had been, he says, communicated in 1813 to the 'Memorie della R. Accademia di Torino'; and, in fact, the receipt of a paper of this nature is acknowledged under date of the 10th January, 1814, but it does not appear to have been published there; on the contrary it is said to have been pushed forward in haste, in order to anticipate the publication of some of Cuvier's works. The main principles of classification adopted by Vieillot are applied by him in his portion of the 'Nouveau Dictionnaire d'Histoire Naturelle' (1816–1819), although some appear to have been modified, in consequence, perhaps, of the criticisms passed upon the 'Analyse' by Temminck. In 1820 Vieillot undertook the continuation of the 'Tableau encyclopédique et méthodique des trois Règnes de la Nature,' commenced by Bonnaterre in 1790; and in 1821 he began the issue of the 'Faune française,' which was left unfinished in 1828. In addition to this, in conjunction with P. L. Oudart, he published the 'Galerie des Oiseaux' in two volumes. It is believed that this prolific author died at Rouen, in 1831, in comparative poverty.

"In the present reprint of the 'Analyse,' the original errors of the press, which are tolerably numerous, have been faithfully reproduced.

"HOWARD SAUNDERS."

Unless a more exhaustive search than I have made should prove otherwise, the next account of Vieillot appeared in 1925 in a book entitled 'L'Evolution de l'Ornithologie,' by Marcel Boubier, published by F. Alcan. Boubier calls Vieillot "le très grand ornithologiste . . . sur lequel on a fait le silence le plus impressionnant." He was, says Boubier, one of the most expert among the masters of the art of naming genera and species, having an insight that enabled him to disentangle forms and separate them into generic and specific types.

FROM BOUBIER'S 'L'EVOLUTION DE L'ORNITHOLOGIE,' 1925

"Louis-Jean-Pierre Vieillot was born at Yvetot, Normandy, May 10, 1748. Like most of the French families of that time, his had interests in Saint Domingue. In

due time young Louis returned to that colony, where he acquired a taste for natural history.

"Banished during the Revolution, he sought refuge in the United States, where he gathered materials for a work never completed on *Les Oiseaux de l'Amérique septentrionale*, published in 1808 in two folio volumes.

"In the meantime, 1800 or 1801, Vieillot had returned to France and had obtained a minor position in the office of the *Bulletin des Lois*.

"This modest post permitted him to pursue his ornithological work and to write a *Histoire des oiseaux dorés ou à reflets métalliques*, profusely illustrated, Paris, 1802, and a *Historie naturelle des plus beaux Oiseaux chanteurs de la zone torride*, folio size, illustrated by 72 colored plates, Paris, 1805.

"In 1816 he published his *Analyse d'une ornithologie élémentaire*. This little book, says Vieillot in his advertisement, had been communicated to the Turin Academy of Sciences in 1813. Indeed, in the Memoirs of that Society one finds a note to that effect, dated January 10, 1814. The promptness with which Vieillot communicated this *Analyse*, in a form so incomplete and hastily written, apparently should be attributed to a desire to anticipate certain works of Cuvier.

"The *Analyse* was the point of departure for Vieillot's great works in systematic and descriptive ornithology, which are scattered through the *Nouveau Dictionnaire d'histoire naturelle*, Paris.

"Vieillot was of a shadowy and difficult nature, a disposition that may be attributed to the degree of his poverty and to the feeling that he was unappreciated. Actually, the Museum always kept aloof from him. Cuvier at that time monopolized natural history in the learned world, and with the public at large Buffon succeeded in defending his prestige. Outside of France certain authors like Temminck had taken to writing in the French language and had started a competition with Vieillot that he did not regard without acrimony. These quarrels with Temminck have proof:

" 'One would think,' wrote the French ornithologist, 'after what he has written on the pigeons and others, that the power to change their names is a privilege reserved for himself alone; for he never fails to revile anyone else who proposes genera and species. This Dutchman published a history of the gallinaceous birds and in 1815 the history of the pigeons, of which he announces a second edition, in which he may perhaps do himself more credit than in the first.'[1]

"Among Vieillot's works a special place ought to be reserved for his *Faune française* (1821–1828), which remained uncompleted. This work comprises two editions, octavo and quarto, with colored plates, which were not all published. It is a truly excellent work, in advance of its time, and complete sets of it are very rare.

"Louis-Pierre Vieillot died in oblivion at Rouen in 1831."

Of Vieillot's family we know little more than nothing, but the death of his two young daughters from yellow fever is recorded in an entry in the Journal of Moreau de St. Méry ('Moreau de St. Méry's American Journey, 1793–1798,' translated and edited by Kenneth Roberts and Anna M. Roberts, Doubleday, 1947). On his return journey from the United States he sailed from Newcastle at midnight on Thursday, August 23, 1798, on the *Adrastes*, arriving at Bordeaux on September

[1] 'Nouv. Dict. Hist. Nat.,' article 'Ornithologie.'

28. Vieillot and his family were also returning to France on this vessel. On September 2, Moreau de St. Méry wrote of the tragic voyage:

"Another night of yellow fever carried off M. Gepory, a colonial from San Domingo.

"At noon they threw overboard another of Pepin's daughters—the blind one.

"The entire ship's company was in a turmoil.

"At high noon M. Neblon died of the same disease.

"My success in the matter of my son's cure made them regard me as a real physician. Nevertheless I had no medicine, no purgatives, no vesicator. Hence I could do nothing, though in these terrible circumstances I would have tried to do something if I had possessed the means. It wasn't long before I again regretted my helplessness. A pretty young girl of eighteen, one of the daughters of M. Vieillot, the ornithologist, was stricken with the fever. Mlle. Euphrosine coughed dreadfully, had spasmodic convulsions like those of rabies, and died in frightful agony. On the twentieth her younger sister, Virginia, was carried off, leaving the parents childless.

"What a scene! What to flee? Death horribly was everywhere in the narrow confines in which we were imprisoned."

There is evidently a family tradition that Vieillot's wife and a third daughter likewise perished on this voyage. This is recorded in the 'Compte Rendu of the Ninth International Ornithological Congress' (Rouen, 1938, p. 32). M. André Sanson, of Gonneville-sur-Honfleur, great-grand-nephew of Vieillot, had furnished some choice Calvados for the banquet of the Congress, and on this occasion he reported:

"Originally from Yvetot, where his grandparents were postmasters, this illustrious naturalist lived with his brother at the Quatre-Mares Manor in the vicinity of Sotteville-lès-Rouen. He went 'aux Amériques' to hunt and naturalize birds, for his brother, shipowner at Rouen, was engaged in the spice trade. During his return voyage, his wife and three daughters, who had accompanied and assisted him, died of a fever contracted in the tropics, and thus lost their lives in the cause of science. The record of Vieillot at the Museum won for him a world-wide reputation as one of the greatest ornithologists of the early 19th century."

Ornithologists since his day have memorialized Vieillot by naming birds after him, and Sherborn's 'Index Animalium' and other lists show that more then twenty-five avian species have borne the name *vieilloti*, *vieillotii*, *vieillotoides*, etc. Payraudeau in 1826 gave the name *Monodonta vieillotii* to a marine gastropod mollusk from the Mediterranean, with the note, "Dédiée à M. Vieillot, le doyen et le plus célèbre de nos ornithologistes." So, certainly, he was not without honor in his own country, even though the encyclopedists overlooked him. To students of Western Hemisphere birds his name is almost as recurrent as that of Linnaeus. When Vieillot came to the United States, Alexander Wilson's 'American Ornithology' held first place among works of its kind; it was not easy for another foreigner to attain front rank in the field. But Vieillot, though never so popular

as Wilson or Audubon, left an imprint on American ornithology that time is not likely to erase, and it is fitting to pay him honor by observing the bicentennial of his birth.

So far as known to me only one likeness of Vieillot is extant, a bust in the bird division of the Paris Museum. Dr. J. Berlioz, Curator of Birds, has kindly furnished me a photograph of this bust for reproduction herewith. Dr. Paul Leverkühn[1] refers to a portrait of Vieillot that he had in his collection of ornithologists' portraits at Euxinograd Castle, Bulgaria, but this turns out to be another view of the aforementioned bust. The Deane Collection of Ornithologists' Portraits in the Library of Congress now has prints of both views.

Grateful acknowledgment is made to the following for information furnished in connection with this summary: Dr. J. Berlioz, Curator of Birds in the Muséum d'Histoire Naturelle, Paris; the Librarian of the Paris Museum; the Librarian of the Blacker Library of Zoology, McGill University, Montreal; Capt. Jean Delacour, of the American Museum of Natural History; Dr. Herbert Friedmann, of the United States National Museum; and Dr. T. S. Palmer. John P. Harrington, Bureau of American Ethnology, has helped me with the translations.

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Washington, D. C.

PASSERINE BIRD POPULATIONS OF THE SAVANNAH RIVER REFUGE, SOUTH CAROLINA[2]

BY ARNOLD B. ERICKSON

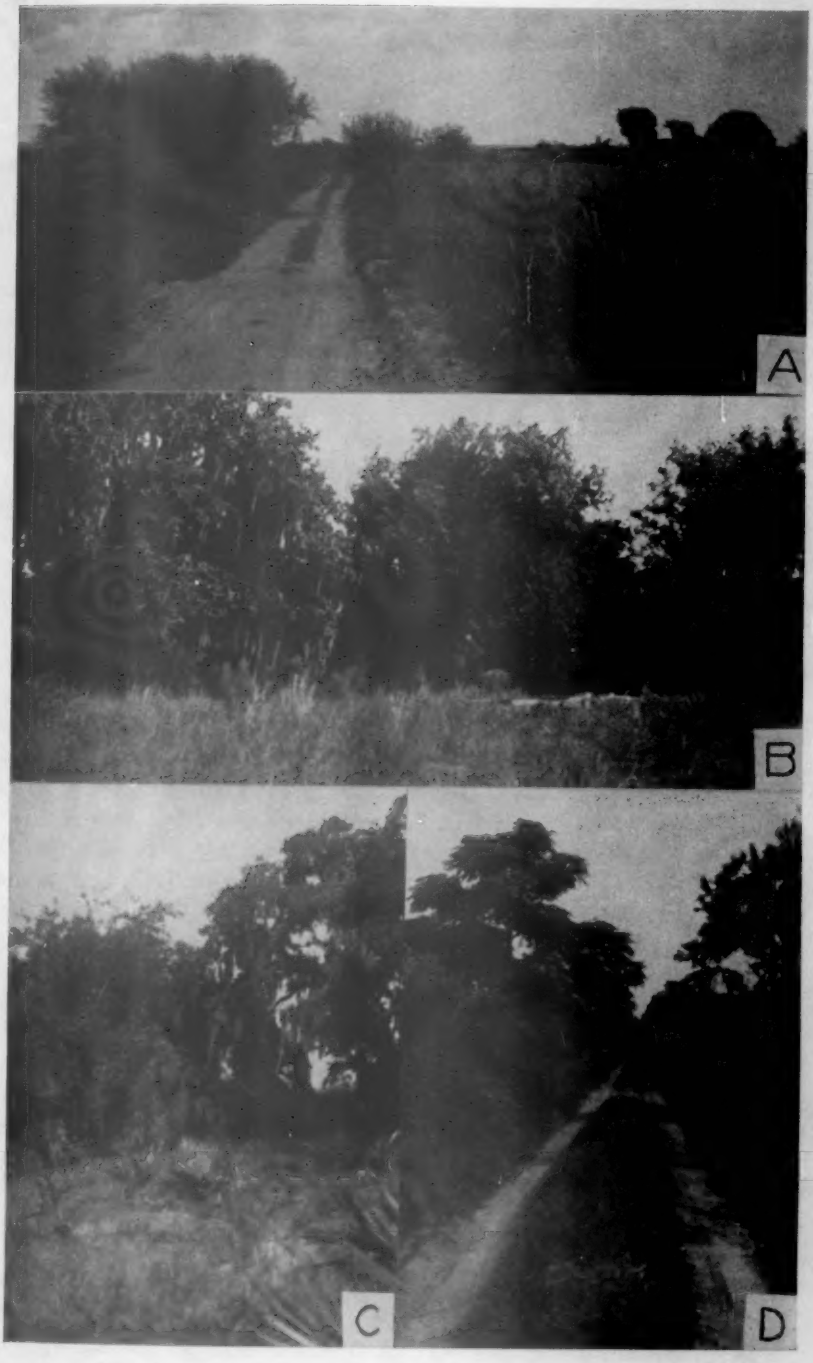
Plate 17

INTRODUCTION

A STUDY of breeding bird populations on the Savannah River Refuge, South Carolina, was conducted from March 26 to August 8, 1946, as part of an extensive investigation on the effects of weekly airplane applications of DDT on wildlife. The U. S. Public Health Service and the U. S. Fish and Wildlife Service coöperated in the investigation. The negative effects of the sprayings on birds have been reported elsewhere (Erickson, 1947). The present paper is concerned with

[1] 'Ornithologists, past and present.' Papers Presented to the World's Congress on Ornithology, pp. 199–208. Chicago, 1896.

[2] From the Communicable Disease Center, Technical Development Division (Savannah, Georgia), in Coöperation with the U. S. Fish and Wildlife Service.



SAVANNAH RIVER REFUGE, SOUTH CAROLINA. (Legend on opposite page.)

bird populations as determined by weekly censuses of singing males and weekly counts of birds on certain islands and dykes of the refuge.

The Savannah River Refuge consists of 1200 acres of marsh lying along the Savannah River about 17 miles from the sea. Before the Civil War and for 20 years thereafter, much of the area was planted to rice (*Oryza sativa*), and some rice is still grown there.

Population studies of breeding birds were confined to a group of small islands and dykes (upland area) near the refuge headquarters and to sections of marsh (lowland area) which paralleled the dykes and extended out 100 feet from them. The 100-foot limit was chosen since birds singing beyond this point might not be heard.

VEGETATION

The dominant plants of the lowland areas, the earliest stage in succession, are cut grass (*Zizaniopsis miliacea*), maiden cane (*Panicum hemitomon*), pickerel weed (*Pontederia lanceolata*), lotus (*Nelumbo lutea*), water lily (*Nymphaea odorata*), jussiaea (*Jussiaea leptocarpa*), and alligator-grass (*Alternanthera philoxeroides*).

The upland areas of the refuge are of two types—hammocks or small islands, the highest stage of succession, and the man-made dykes connecting them. The dominant trees of the islands include live oak (*Quercus virginiana*), water oak (*Quercus nigra*), sweet gum (*Liquidambar Styraciflus*), pignut hickory (*Hicoria glabra*), hackberry (*Celtis laevigata*), and loblolly pine (*Pinus taeda*). Dominant trees of the dykes are Chinaberry (*Melia Azedarach*), Chinese tallow tree (*Sapium sebiferum*), and black willow (*Salix nigra*). Dominant shrubs of the islands and dykes include dwarf palmetto (*Sabal minor*), bayberry (*Myrica cerifera*), alder (*Alnus rugosa*), blackberry (*Rubus* sp.), winged sumac (*Rhus copallina*), yaupon (*Ilex vomatoria*), pepper vine (*Ampelopsis arborea*), St. Andrew's cross (*Ascyrum hypericoides*), French mulberry (*Callicarpa americana*), button bush (*Cephalanthus occidentalis*), elder (*Sambucus canadensis*), and silverling (*Baccharis halimifolia*). Dominant herbaceous plants include small cane (*Arundinaria tecta*), spiderwort (*Tradescantia pilosa*), Spanish moss (*Tillandsia usneoides*), inkberry (*Phytolacca americana*), partridge pea (*Chamaecrista* spp.), periwinkle (*Vinca major*), May-pop (*Passiflora incarnata*), dog fennel (*Eupatorium capillifolium*) and lettuce (*Lactuca* spp.).

The islands, dykes, and the 100-foot-wide marsh strips formed three ecological types. The islands (live oak forest) with their mature trees (Plate 17) and understory of vines and shrubs are at present the climax stage. The marsh (cut grass, pickerel weed, jussiaea marsh) with its various aquatic plants (Plate 17) is a widespread early seral

stage. The dykes (raspberry, silverling, tallow tree shrubs), which are artificial structures (Plate 17), may be regarded as an intermediate stage with shrubs the dominant form plus a few introduced trees like Chinaberry.

STUDY METHODS

In February, before the nesting season began, the islands near the refuge headquarters were mapped, and numbered stakes were set out in rows 100 feet apart, with 100 feet between the stakes in each row. One row of numbered stakes was also placed on each dyke with 100-foot intervals between the stakes. One hundred feet of marsh on each side of the dyke were included in the dyke census areas. The stakes on both islands and dykes were used as location markers for the census of singing males and for live trapping mammals.

A bird census of one study area was conducted each Wednesday morning from March 25 to August 8, between 6 and 10 o'clock. On Thursday mornings the second area was censused. Fresh maps of each individual island and dyke were used for each census. Census routes followed the line of numbered stakes on the islands and dykes. The location of singing males was easily determined by referring to the stakes, and the positions of the birds were then readily plotted on the maps. The weekly observations of individual singing males were consolidated at monthly intervals on maps, one for each species. At the end of the season these maps were used to determine the number of pairs of breeding birds on the study areas.

A count of the total number of birds seen or heard or both (not singing) was made on each weekly census trip. These counts were used as a check against the number of singing males in determining the number of pairs of birds on the area. In this way, too, it was possible to determine the number of pairs of certain non-singing birds. The singing-male census cannot be used alone to determine total populations.

BIRD POPULATIONS

On 35 acres of census islands there were 215 pairs of breeding birds as determined by census of singing males and sight records. Calculated on the basis of 100 acres (40 hectares) there would be 614 pairs of breeding birds on the islands. On the 47.48 acres of dyke and marsh, which areas were studied as a unit, there were 177 pairs of breeding birds. On the basis of 100 acres there would be 373 pairs of breeding birds on the dykes and marsh. Considering the study area as a whole, there were 392 pairs of breeding birds on 82.48 acres.

On the basis of 100 acres there would be 463 pairs of birds. This information is summarized in Table 1.

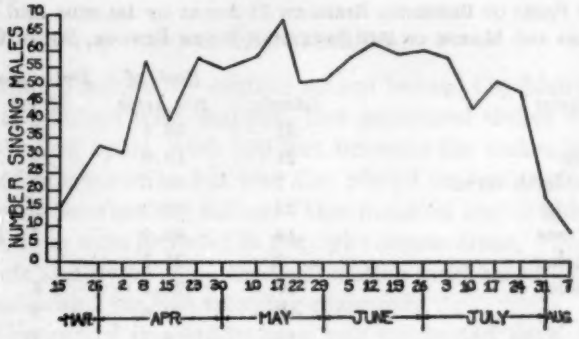
TABLE 1

NUMBER OF PAIRS OF BREEDING BIRDS ON 35 ACRES OF ISLANDS AND 47.48 ACRES OF DYKES AND MARSH ON THE SAVANNAH RIVER REFUGE, SOUTH CAROLINA

Species	*Islands*	*Basis of 100 Acres*	*Dykes and Marsh*	*Basis of 100 Acres*
Red-wing	31	88.5	57	120
Yellow-throat	21	60.0	29	61
Long-billed Marsh Wren	7	20.0	22	46
Purple Grackle	23	65.7	5	10.5
Mourning Dove	14	40.0	7	14.7
Brown Thrasher	9	25.7	7	14.7
Orchard Oriole	10	28.5	6	12.6
Kingbird	8	22.8	7	14.7
Cardinal	10	28.5	5	10.5
Carolina Wren	9	25.7	5	10.5
Mockingbird	9	25.7	3	6.3
Yellow-billed Cuckoo	9	25.7	3	6.3
Crested Flycatcher	8	22.8	1	2.1
Blue Jay	7	20.0	0	0.0
Catbird	3	8.5	3	6.3
White-eyed Vireo	3	8.5	3	6.3
Flicker	4	11.4	2	4.2
King Rail	0	0.0	6	12.6
Parula Warbler	5	14.0	0	0.0
Yellow-breasted Chat	3	8.5	2	4.2
Painted Bunting	5	14.0	0	0.0
Carolina Chickadee	2	5.7	2	4.2
Red-bellied Woodpecker	3	8.5	0	0.0
Downy Woodpecker	3	8.5	0	0.0
Yellow-throated Warbler	2	5.7	0	0.0
Blue-gray Gnatcatcher	0	0.0	2	4.2
Starling	2	5.7	0	0.0
Barred Owl	1	2.8	0	0.0
Chuck-will's-widow	1	2.8	0	0.0
Loggerhead Shrike	1	2.8	0	0.0
Red-eyed Vireo	1	2.8	0	0.0
Summer Tanager	1	2.8	0	0.0
Total	215	612.6	177	371.9

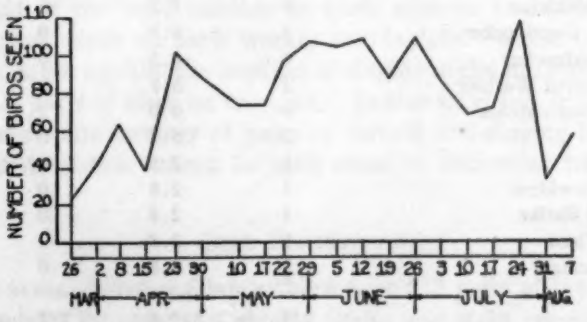
The large population of 392 pairs of birds, mostly passerines, on 82.48 acres resulted from the variety of habitat. The marsh area contributed heavily to the population with its many pairs of Long-billed Marsh Wrens, Yellow-throats, and Red-wings. The population on the highest developmental stage, the islands with mature deciduous

trees, was also large—215 pairs on 35 acres or 614 pairs per 100 acres. Bird populations in beech-maple forests in various northern states are usually much smaller (Kendeigh, 1944).



TEXT-FIGURE 1.—Showing by weeks the number of singing males heard on 56.3 acres of islands, dykes, and marsh of the Savannah River Refuge, South Carolina.

The number of singing males, 20 species, heard from March 15 to August 7, on the 56.3 acres of islands, dykes and marsh in the area near the Refuge headquarters is shown by weeks in Text-figure 1. Singing males increased from a low point at the beginning of the nesting season, fluctuated mildly during the season, and then dropped off at the end of the season.



TEXT-FIGURE 2.—Showing by weeks the number of mature birds seen or heard calling or both on 56.3 acres of islands, dykes, and marsh of the Savannah River Refuge, South Carolina.

The number of birds, 14 species, seen or heard calling or both (not singing) on the weekly census of the headquarters area (56.3) acres

from March 26 to August 7, is given in Text-figure 2. Populations increased rapidly from the low of March 26, to a peak between April 23–30, the height of the migration, and then fell to a lower level by May 1. A new wave of migration brought the population up again after May 17. For the remainder of the breeding season the population fluctuated mildly, and then spurted up near the end of the season when some immature birds were probably counted with adults.

TERRITORY AND SONG

Catbirds, Brown Thrashers, Cardinals, and Towhees fill the air with their early morning territorial singing in the basswood-maple forests of Minnesota. At the Savannah Refuge and elsewhere in the South Carolina and Georgia Southeastern Coastal Plains Area, I missed the fervent outpouring of early morning song. There was singing by the species mentioned but never with the strength, challenge, and volume that I have heard in the singing of these species in Minnesota and Wisconsin. I am not trying to say that southern birds in the Southeastern Coastal Plains Area are more leisurely in their ways of life, but to me they did not sing with the same zest and abandon of birds of the basswood-maple forests of Minnesota.

What conditions or factors might cause these differences in quantity and quality of song? One important factor, it seems to me, is that certain sedentary species in the Southeastern Coastal Plain do not have to protect their territories by song and chase as valiantly as do these same species in the basswood-maple forests of the North. In the Southeastern Coastal Plain these sedentary species occupy much the same territories summer and winter despite occasional shifting about. At the beginning of the reproductive season they know pretty well where they fit in. The boundaries of their territories are already more or less established, and there is not the contest for space that results with the influx of a host of migrating birds such as come with the northern spring.

Nice (1941) cites several authors who emphasize that some sedentary birds maintain territories throughout the fall and winter. Also she quotes from Skutch (1940) who believes that Central American birds which "have the entire year in which to adjust conflicting territorial claims, to settle amorous disputes . . . may gradually come to an understanding without violence."

Some summer residents of the Savannah River Refuge, like the Red-eyed Vireo, Yellow-throated Warbler, Parula Warbler, and the Long-billed Marsh Wren, which migrate greater or lesser distances in the fall, sang much more consistently and provocatively on their territories

than the sedentary species. They sang as though they had territories that were in danger of invasion.

The long nesting season at Savannah—from February to August—is another condition influencing quantity and quality of song. Some species are through nesting or engaged in non-singing phases when others are just beginning to sing. In the deciduous forests of the North most species are competing and singing at the same time. Thus the volume of song uttered during any part of the long nesting season in the Southeastern Coastal Plains would be less than the volume of song poured forth during the relatively short nesting season in northern deciduous or coniferous forests.

Temperature is another factor that influences song. Dr. Eugene P. Odum tells me that in the deciduous forest region at Athens, Georgia, the morning chorus is definitely shorter than farther north in cooler temperatures, and that by June there is very little singing after 9 A. M. at Athens, and even by 6 A. M. many birds have stopped singing. One has to be on an area at dawn to get the full morning chorus.

At the Savannah River Refuge and on the outskirts of the city of Savannah I never heard what I considered a full morning chorus, despite the fact that the temperature was decidedly cool on many early mornings in April and May. A comparison of the quantity of song at 4 A. M. and 6 A. M. at the Refuge convinced me that it was preferable to start the census of singing males at six rather than at four because the volume of song was greater at the later hour.

The difference in species composition of the Southeastern Coastal Plain and a northern basswood-maple forest might also influence the quantity and quality of song. Warblers, vireos, sparrows, and thrushes of several to many species are persistent singers in northern hardwood forests. At the Savannah Refuge only four species of warblers, two vireos, three sparrows, and no thrushes were recorded. The warblers, vireos, and one of the sparrows are summer residents at the Refuge, and like other migratory species they did considerable singing.

Another factor that might influence quantity and quality of song is

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Plate 17

SAVANNAH RIVER REFUGE.—A. Dyke-marsh census area. Marsh is dominated by cut grass (*Zizaniopsis miliacea*), a favorite habitat of Long-billed Marsh Wren and Yellow-throat. B. Island with mature Live Oak and Water Oak. Yellow-throated and Parula Warblers nested in the Spanish Moss. C. Island with mature Live Oak, Pignut Hickory, and an understory of Dwarf Palmetto. Brown Thrashers and Towhees were common. D. Dyke with Chinaberry Trees, Chinese Tallow Tree, Silverling and other shrubs. Red-wings, Yellow-throats, Brown Thrashers, and Long-billed Marsh Wrens nested along the dyke and adjacent marsh.

type of habitat. A large marsh area open to the sun and harboring many non-singing species of birds cannot be compared with suburban areas of lawns where the morning chorus is at its best. Much of the census area at Savannah, it is true, was marsh or adjacent to marsh, but almost half of it was grassy brush islands shaded by large trees and not unlike certain suburban areas.

In conclusion, it is certain that the amount and intensity of song do differ in different geographical and ecological communities, and that more attention needs to be given to study of these differences. The amount of song has an important bearing on technic of census work. In the Southeastern Coastal Plain, for example, one cannot make an accurate determination of breeding birds in many habitats by simply walking through the area and listening, as can be done in a warbler-filled northern coniferous forest. Individual birds and pairs must be observed as well as heard to obtain a complete count.

SPARE NESTERS

A few species like the Red-eyed Vireo, Blue-gray Gnatcatcher, and the Summer Tanager nested very sparingly on the Refuge. They were commonly present in the early spring, scarce during the nesting season, and then fairly common again early in August. Apparently many birds of these species had nested abundantly just a few miles farther back from the coast and appeared suddenly in August as did the Indigo Bunting which did not nest on the area.

ACKNOWLEDGMENTS

I wish to express my sincere appreciation to Dr. Eugene P. Odum, University of Georgia, for a critical reading of the manuscript and for comprehensive suggestions and criticisms on the section "Territory and Song."

SUMMARY

1. A study of breeding bird populations on the Savannah River Refuge, South Carolina, was made from March 26 to August 8, 1946.

2. The islands, dykes, and marsh of the Refuge form three ecological units: live oak forest on the islands; raspberry, silverling, tallow tree shrubs on the dykes; and cut grass, pickerel weed, jussiaea marsh.

3. On 35 acres of census islands there were 215 pairs of breeding birds as determined by census of singing males and sight records.

4. On 47.48 acres of dyke and marsh there were 177 pairs of breeding birds. Bird species of the islands, dykes, and marsh are listed in Table 1.

5. Birds of the Refuge and birds observed elsewhere in the Southeastern Coastal Plain of South Carolina and Georgia did not seem to sing with the same zest and abandon as birds of the basswood-maple forests of Minnesota.

6. It is certain that the amount and intensity of song differ in different geographical and ecological communities. Some of the factors discussed that might influence song in different communities were: more non-migratory species; probably less defense of territory; the long nesting season at Savannah spreads the volume of song over a longer period than in the north; temperature influences the amount and volume of song; the difference in bird species composition of areas is important; type of habitat affects song.

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THE BIRD NAVIGATION CONTROVERSY

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SINCE the comprehensive review by Griffin in 1944, new experimental work has brought new interest, new apparent contradictions, and has removed the study of bird navigation from the realm of speculative thought. It is especially stimulating that this progress has been a coöperative endeavor of many of the older disciplines meeting in this field of geophysical ornithology. At this time there is a controversy that may be stated as follows: Is the superior navigation of birds possible because of their possible ability to orient to a Coriolis, magnetic, or other geophysical field of force in addition to keen powers of visual reference? Or do visual reference and sense of direction alone

permit these remarkable flights? The evidence prior to 1944 was carfully reviewed by Griffin (1944).

The problem may be divided into two parts: I. Migration from unknown territory to known territory (artificial homing). II. Migration in known territory (the normal condition for the wild bird). "Known territory" implies either learned or inherited knowledge. The present evidence reviewed by Griffin (1944) suggests that the urge for southward flight and the southward flight ability may be inherited, since isolated young birds can make these flights. But the return flight in one species, at least, seems more a function of learning (Valikangas, 1933).

YEAGLEY, MAGNETISM, AND CORIOLIS FORCE

Beginning in 1941, Yeagley (1947) in coöperation with the U. S. Army conducted five sets of experiments with homing pigeons and combined the very old magnetic theory (Viguier, 1882) with his idea of the action of Coriolis force. Thus he postulates that birds can and do orient to a grid formed by lines of equal Coriolis force and lines of equal magnetic dip. He suggests that birds detect the magnetic dip by detection of electromotive force produced within the bird as it flies through the magnetic field of the earth. He postulates that Coriolis force is also detected during flight. His experimental evidence because of its importance is discussed in detail below.

In Yeagley's *first experiment*, eight out of ten trained homing pigeons with an .8 gram copper plate sewed to the metacarpals of each wing returned 65 miles to Paoli, Pennsylvania, on November 7, 1943, within two days after release. Some had lost one or two plates. In comparison, only two out of ten birds with .8 gram magnets returned, and these in four days. He concludes that the magnetic fields of the magnets interfered with normal homing. The statement is made: "Since these birds were well trained and out-standing homing pigeons, Mr. Gable and others expert in the field expected at least two or possibly three of those with two magnets to home, just on the basis of their intelligence and ability to 'hunt' their way home. On the basis of probability and chance a similar prediction would obtain."

These are peculiar statements. The degree to which the birds home by other than visual 'hunting' methods is the thing being tested. How can one know just from experience with pigeons what per cent is due to visual and what per cent is due to sense of direction from the possible magnetic aid that is postulated? And on what basis is such a probability prediction made? As shown below, other workers account for much more rapid returns by random hunting. It seems that this

experiment is most important and that it needs to be repeated. It is not impossible that on this one occasion the ratio was accidental or a function of other unknown factors peculiar to the magnets.

The unsubstantiated results so far suggest that a rapidly changing magnetic field interferes with homing. Even if this is true, a change in the electromotive force field of the bird, according to Yeagley's hypothesis, is not necessarily the mechanism of interference. Varian (1948), Slepian (1948), and Davis (1948) independently in letters to the 'Journal of Applied Physics' point out that according to relativity the bird has no way of detecting its own electrostatic field since all of the bird is cutting the magnetic lines and all of the bird has the gradient. As they indicate, even if the bird had the sensory mechanism it must measure the difference between bird and atmosphere. Measuring this gradient of about 10^{-5} volts/cm. by comparison with the atmosphere is not feasible because of the extremely variable atmospheric electrostatic fields of magnitudes up to one volt/cm. or higher in clouds (Gunn, 1948). Thus they reject this mechanism.

Varian and Davis instead suggest that there might be some direct magnetic mechanism. Such a mechanism presumably would not depend on motion of the bird. Attempts to train three homing pigeons to respond to a magnetic field were negative (Griffin, 1944) whereas success was obtained with light responses or air current stimuli. As yet, apparently, there are no instances known among animals where even large magnetic fields have been detected.

Henderson (1948) opposes the magnetic theory. During the war he served on a Canadian mine sweeper. He describes the reactions of wild birds to intense magnetic fields used in mine detection. "Birds appeared to be supremely indifferent to magnetic fields even at the sudden beginning of magnetic pulsing." On the other hand there are some observations that claim interference by radio stations with homing (Aymar, 1936). These are mostly fragmentary.

In addition to direct magnetic detection and detection of the electrostatic field created by flight through the magnetic field of the earth, there is the third possibility that the rapidly moving magnets on the wings might be felt by the bird whereas constant magnetic and electrostatic fields might not be felt. Varian and Davis independently make the excellent suggestion that the homing experiments be repeated with magnets attached to the body.

Dr. J. T. Zimmer (personal communication) has pointed out that the pigeon wing beat (about 8 per second) is far less than the 180 beats per second that Yeagley used in figuring .12 microvolts/cm. as the magnitude which alternates from positive through zero to negative

for each beat. Thus, if the bird can detect this oscillation it is even more sensitive than Yeagley postulates in his paper.

Apparently satisfied with magnetism of the earth playing some role, Yeagley next experimented to see if the pigeons would home to a point in Nebraska which had approximately the same magnetic and Coriolis force field (although reversed in east to west direction) as the place in Pennsylvania where the pigeons were trained. Since the magnetic poles do not correspond to the regular poles, the circles of equal vertical component of magnetic force intersect the Coriolis force lines (which coincide with the latitude lines) in two places.

In this *second experiment* 43 birds were reported by telegraph out of 98 Pennsylvania-trained birds, which were released at eight points on eight days, 25–100 miles in all directions from Kearney, Nebraska. Six of eight of the vector sums of each day's returns converge on the Coriolis-magnetic conjugate point corresponding to the Pennsylvania training. Only one bird actually found a loft. Certainly visual orientation as stated by Yeagley is indicated in these experiments as the mechanism within ten miles, since the loft was rarely found. Apparently, the lofts with birds that were moved to Nebraska were kept near Kearney and thus near the conjugate point prior to their release. It would have been better if the loft had been kept elsewhere so as to eliminate the possible use of sense of direction of some sort. Twelve additional birds liberated 100 miles east of the conjugate point, apparently without ever having been near the conjugate, gave a good vector for six reported birds. The winds for the 14th to the 17th of May, 1944, were SE, SSE, and SW, roughly giving a resultant to the north. Here the birds were evidently unaffected by the wind. Twelve untrained birds that had spent a year caged in Pennsylvania gave a random pattern in Nebraska. This was interpreted as showing that the magnetic orientation in homing pigeons had to be trained.

G. E. Hutchinson (1948) pointed out that the returns from the west were not as satisfactory as the others. At the time of the main experiment the weather map shows winds: NE, E, SE, S, NE, E, SE, E, S, respectively, from June 29 to July 7. The total vector of winds is very roughly to the WNW. In the first two days the wind was ENE. In this case, at least, the winds might be considered as contributing to the vector sums from the east. Finally twelve young birds trained in Nebraska were liberated 100 miles south of the Pennsylvania conjugate; the vector sum of reported birds was northward toward the conjugate. The weather map shows SE flow on these days. This might have had an effect.

Considering all the releases of this experiment, there apparently is

confirmation for the latitude-magnetic grid orientation theory. But these results are possibly subject to the criticisms above and those to follow. Unfortunately three out of ten old birds from Nebraska with long flight experience, when released in Pennsylvania homed to Nebraska, and three more went part way in this direction.

In Yeagley's *third experiment* he tested to see if there was a tendency for the birds to retrace the path along which they were transported. Fifty-four were reported out of 250 pigeons released in Nebraska on one day. Most were untrained and the flight vectors were short. Of the few trained birds, six made flights toward original homes in the southeastern U. S. even though they had come to Nebraska via New Jersey. However, a look at the weather maps for the 30th of September and 1st of October, 1944, shows that a cold front passed on the 30th of September with the usual accompanying strong NW winds at all levels. It is not apparent why the untrained birds were used since it is already accepted that homing ability in pigeons must be brought out by training, although the capacity is inheritable. Thus the data of six birds is not convincing. It seems too bad that in other experiments the loft was carried first to the conjugate point prior to birds being released near by.

In the *fourth experiment*, 44 birds trained in Pennsylvania were released in a band between Pennsylvania and Nebraska. The latitude lines and magnetic lines become parallel in a region half way between so that it was expected that birds in this region would go either east or west. The resulting vectors of birds reported confirmed expectations, with birds east of the parallel region going east, those west going west, and those within 100 miles of the parallel region going both ways. There were flight components in direction of conjugates of about 2300 miles compared to perpendicular coördinate components of about 500 miles. The eastern-released birds went east and the western-released birds went west for 1950 miles compared to 76 miles in the unexpected direction. The behavior of the western group seems to be Yeagley's best evidence for the theory, especially since the birds had never been west before. It should be noted that the birds were carried in an east–west direction prior to their release. The point of lowest elevation is half way between the conjugate points. The weather maps show a stationary front oriented from NE to SW half way along the route so that there was a tendency for NE winds in the west and SW winds in the east. Thus Yeagley's evidence is here subject to three additional interpretations.

In Yeagley's *fifth experiment*, 200 birds were trained to return to the Pennsylvania station always from release points to the northwest.

These same birds were released to the northeast of the Nebraska conjugate point. The 32% recovery had vectors with components of 2621 miles toward the point compared to 43 miles away from the point. The winds on the weather map were NW for three days, becoming S and E. So in this case the winds support the experiment. This confirms earlier experiments indicating that Pennsylvania birds tend, when released east and northeast of the Nebraska point, to go toward the conjugate. The components perpendicular to the release-conjugate line were about equal on either side, although Yeagley minimized this by adding them algebraically. Although a portion of his data does not apply, there is definitely an apparent confirmation at least of there being a latitude-longitude grid of some detectable quantity which reversed direction half way between Pennsylvania and Nebraska. But more controls are needed with releases other than in the east–west band and in other pairs of conjugate points. Experiments are needed to rule out winds and other effects such as elevation that are inherent in the geographical situation. A very important fact not pointed out is that the Platte River runs from a point NE of the conjugate at Kearney toward the town and then NW. A bird flying up river or toward the river would have a component toward Kearney. As previously stated the western results were not good.

It is unfortunate, from the nature of the bird recoveries, that the speed of their movements is not known. If the birds were to scatter in a random manner, the center of distribution would shift in the direction of the net wind vector during the two to six days in which most of the recoveries of Yeagley's experiments were made. Or if the birds maintained a constant latitude, the longitudinal center of distribution would shift in the direction of the net east–west wind component. In Yeagley's experiments the birds might have flown toward the conjugate in two hours and then spent the rest of the time wandering in the vicinity of the conjugate. If, on the other hand, the flight of these birds was evenly distributed over the several days before telegraphed reports came in, then their speed is extremely low. For example, in Yeagley's first Nebraska experiment, the vectors amount to only 6 to 18 miles per day whereas such a movement could be made in less than an hour, or the wind could have blown the birds that far in less than an hour. It is thus highly desirable that such experiments be closely tabulated with wind vectors. In any case, if this magnetic effect is a valid one it is not possible to tell from these experiments whether there is any real aid to the bird. As Griffin has shown, a wandering search by the birds could get them home quicker than the time of this experiment. Yeagley's experiments don't tell us which is the case.

These pigeon experiments differ in one major way from remarkable homing in wild species such as the homing of Noddy Terns from Texas to Tortugas. Pigeons have to be trained, which apparently allows them to learn part of a region among other things. Wild birds already know a region and may inherit some responses. This might be the only difference. There is no reason why the urge to migrate and the path taken are different from other inherited behavior patterns with visual releasers.

No experimental work was done to test the Coriolis force theory. The only evidence at this stage for Coriolis force orientation is that birds seem to orient to latitude, and Coriolis force lines parallel latitude lines. Coriolis force is discussed below in connection with Ising's theory. Yeagley, like most other students of migration, applied his theories to both homing from unknown regions and movements in known regions.

ISING AND CORIOLIS FORCE

Independently at the same time, the Swedish physicist, Ising (1946), postulated the theory that birds (or other animals) might orient themselves by detecting the Coriolis force in the semicircular canals or other organs whenever the organ was subjected to velocity relative to the earth. He visualized birds turning their heads so that the rotation of the earth's horizon plane including them might be felt as an extremely small force on some sensory hairs or other sensory mechanism. This is somewhat different from Yeagley's idea of the Coriolis force acting because of the flight velocity of the whole bird. (*Coriolis force is the force exerted by the rotating earth upon any object which has velocity relative to the earth. A train traveling across the earth has a velocity relative to space. The earth in rotation is rotating the horizon plane (and thus the rails) to the left (in the Northern Hemisphere or right in the Southern Hemisphere). The moving train thus experiences a force from the right rail. This changes the direction of motion with respect to space. Similarly there are vertical components of Coriolis force. The horizontal component is zero at the equator since the plane of the horizon is not rotating. That is, two objects do not turn laterally about each other with respect to space. The horizontal components of Coriolis force are maximum at the poles where the horizon plane rotates at the same rate as the earth or once a day. The force is proportional to the velocity of the object relative to the earth. Thus the acceleration works out to be*

$$A = 2\omega V \sin \theta.$$

where ω is the angular velocity of the earth, V the velocity of the object relative to the earth and θ the latitude measured in degrees.)

Ising constructed a rotating device and actually measured the calculated force in good agreement.

Thorpe and Wilkinson (1946) discussed Ising's work. They pointed out that the magnitude of the Coriolis force in small birds would be of the same order of magnitude as forces resulting from Brownian movement and thus not to be considered as detectable without further heretofore unknown mechanisms. The forces acting on the whole bird in flight, as suggested by Yeagley, would be larger but would still be very small and, as pointed out by Hutchinson (1948), difficult to prove physiologically. Davis (1948) suggests the possibility of detection of Coriolis force on moving blood streams. However, Varian (1948) suggests that a supersensitive new organ other than one already in use for other sensory detection is less likely to evolve without natural selection, and natural selection could not act until the organ became supersensitive. This would be true if more than one or two mutations were involved.

As pointed out independently by Hutchinson (1948) and Davis (1948), the bird, in order to evaluate the Coriolis force, must know the velocity of his head in the case of the Ising idea or his ground speed in the case of the Yeagley proposition. It was already noted that the electromotive force interpretation of magnetic orientation required a ground speed determination also. The idea was brought out by Yeagley that in haze and fog birds get lost and homing pigeons can't home. Of course, if visual orientation is the only navigation method, then it, too, would be thus interrupted. As seen below, some homing is independent of visual references. Bender (1948), in his review of Yeagley, pointed out that over water ground speed could not be obtained. However it should be pointed out that this is not a valid objection. Almost never is the sea smooth. Ripples, swells, and whitecaps, although in motion themselves, serve as enough reference up to 4000 feet for detecting ground speed. That this is true is known from the standard procedure of aviation over the ocean whereby the wing velocity of the air mass in which the plane is embedded is told from 'double drift' measurements in reference to the sea surface. The surface wind, when over 10 knots as it usually is, may be told easily by the direction of streak of the whitecaps. Of course there would be much greater error due to movement of water patterns in the case of birds than with airplanes because of the smaller air speeds of birds. Incidentally, pigeons as well as other birds home successfully from miles at sea.

But there seems to the reviewer that there is a more fundamental objection to the Coriolis force determination by a bird in flight.

Yeagley's mechanism of detection of Coriolis force involves the bird feeling the deviation of his flight path produced by the earth rotating him. This action by the earth presumably acts through the medium of the atmosphere. However, the air is not rigidly attached to the earth. Movements of the atmosphere are most often initiated by differences in the pressure gradient and thus determined by the positions of highs and lows, etc. The air begins to move across the pressure gradient but the horizon plane of the earth is rotating beneath it and, so to speak, out from under the air flow. To the observer on the ground the air flow is being forced to the right whereas in relation to space it is the observer whose line of vision is being rotated to the left (Northern Hemisphere). Eventually the air flow obtains an equilibrium, with the apparent Coriolis force balancing the pressure gradient force and the air flowing parallel to the lines of equal pressure. The main point is that the positions of these high and low pressure areas are subject to many other meteorological factors and their own cycles so that they change in position and intensity with time, place and altitude even in the regions of the earth where the pressure systems are fairly constant. Furthermore, a bird flying across the earth's surface is crossing from one pressure pattern to another. Thus the air velocities and accelerations in horizontal and vertical are a function of changing patterns as well as the continual rotation of the horizon plane. A bird thus flying in the air must be able to distinguish which of the forces that it feels is due to wind systems and which is due to Coriolis acceleration. This seems impossible. And it must make these very small measurements and correlate with a very accurate determination of ground speed. For these reasons detection of Coriolis force is considered skeptically at this time. Once again these discussions apply both to homing from unknown regions and migration over known regions.

GRIFFIN: VISUAL RECOGNITION AND WANDERING

The theory of visual orientation really has two parts.

A. First, a bird in unknown territory wanders perhaps with a sense of returning to an altitude, to a given sun orientation, to a given vegetation appearance, or to some other visual gradient until it finds a recognizable landmark.

B. Secondly, a bird in known territory may seek other territory by following recognizable geographical patterns and by flying directed headings between recognizable landmarks. This latter ability is apparently a function of:

(1) learned behavior and

(2) inherited responses coupled with
(3) an ability to maintain constant flight direction.

This ability to fly straight may be a function of:

(a) the ability to remember direction changes just as a person in a train knows when it is turning; and
(b) the ability to maintain a constant angle with respect to heavenly bodies or some terrestrial objects.

It is generally accepted that some of bird navigation especially over short distances is accomplished by this visual recognition theory. The question is how much? Griffin (1944, 1948) is one of the main modern proponents of this theory which he clearly formulated although slightly differently from the expression above. He suggests that this method of orientation is adequate to account for all but a few unsubstantiated cases.

Griffin and Hock (1948), with an airplane, followed 9 out of 16 Gannets from a release point 100 miles inland from their nests. The paths as far as they were followed were looped, twisted, and of the wandering type. These authors ruled out the airplane as having affected the flight path because the birds followed for one to nine hours arrived back at the nest at the same rate as the other birds. The average speed of return of 99 miles per day compared well with speeds of homing of six other wild species of 38–141 miles per day. Pigeons over previously flown routes have covered 500 to 1000 miles in a day. This speed discrepancy suggests a difference between wandering from unknown territory and movements in known territory. But Yeagley's pigeons had net vectors that were only a fifth of that of the wild birds in apparently unknown territory. As mentioned above there is no way to tell if this is an artifact of the experiments or not. As Griffin pointed out (1944), if a bird flew outward in an Archimedes or other more random spiral it would be flying rapidly enough to account for almost all homing records. The Gannet results seem to confirm this idea and suggest that magnetic detection in pigeons is grossly ineffective or not present at all. Of course there is the possibility that the birds followed by airplane made up for lost time later, and if otherwise undisturbed would have flown direct courses. More birds should be followed. A very short wave PPI radar scope would be ideal for this job. Perhaps the coöperation of aviation may be secured for this purpose. Saville (1948) draws a distinction between migration and homing on the basis of the much greater speeds with migration under certain conditions and because migration seems more inherited than homing. However from the point of view of navigation ability, once the bird has the mental behavior patterns established, either by

inheritance or by learning, the problem is the same. The difference between migration and artificial homing can be considered as being the difference between movement in known and unknown territory.

One of the mechanisms of orientation of some insects involves a combination of landmark recognition, following olfactory trails, and orientation to a constant angle with the sun by means of two rigid compound eyes. This latter is the light compass reaction known to exist in ants. Insect orientation is summarized by Wigglesworth (1947). That birds may maintain constant angles of visual reference is not unreasonable especially since there is an eye on each side of the body axis in birds and since there is little eyeball movement. It should be mentioned that the pecten projecting into the eyeball might possibly have some effect here. Crozier and Wolf (1943) postulate that the pecten increases contrast. The pecten theories were discussed recently by Pumphrey (1948). If a bird were maintaining an orientation to a heavenly body on the horizon, with the rise of this object above the horizon the bird might, in the course of time, shift its orientation to the next appearing heavenly body. Or at least it might gradually shift its orientation. For north–south flight the rotation of the earth changes the elevation of heavenly bodies mostly at right angles to the flight path in comparison with a change of flight direction which would change the azimuth. It is an interesting possibility that an illuminated terrestrial object at night might serve as an orientation reference. A bird under these conditions might converge in a logarithmic spiral as suggested for insects because of its flying at a constant angle (Buddenbrock 1917). Sometimes lighthouses get large concentrations of birds which strike or fly around, confused. Constant flight direction over the sea may be accomplished by visual reference to the ocean swell patterns that are almost always present.

Sense of direction without visual reference is a different thing. Brewster has cited homing of auklets and murres to Alaskan rookeries through fog. It is likely that birds are very sensitive to any accelerations produced by change of flight direction just as a person on a train senses a turn. There may be some gyroscopic stabilization by the wing beat. But this sense is apparently not the orientation method for artificial homing experiments where the bird is initially lost. Exner obtained usual homing by birds anesthetized, rotated, and electrically shocked during transport. However, these experiments have been criticized by Griffin (1944).

Infra-red light has been suggested as an aid through clouds, at night, and around the curvature of the earth. However, as yet all

experiments on birds show negative sensitivity (Hecht and Pirenne, 1940; Matthews and Matthews, 1939).

In oceanic regions, especially in the trades, the typical air mass is modified somewhat in passing across islands so that the lee flow has different cloud appearances. This might enable birds to locate these islands visually.

CONCLUSION

1. The extreme smallness of the Coriolis force of the order of magnitude of Brownian movement forces, the absence of experimental or direct theoretical support, and in the case of the flying bird the impossibility of separating the Coriolis acceleration from atmospheric accelerations and the difficulty of making the necessary correlations with ground speed seem to rule out the Coriolis force as a factor in bird navigation.

2. Experiments testing the direct action of magnetism on homing pigeons, although positive, seem unsatisfactory and need to be repeated and enlarged.

3. It is unlikely that magnetism can be detected by a bird through the mechanism of the electrostatic field induced within the bird as it flies through the earth's magnetic field. This is because there is no way to measure the force, since the variations in the atmospheric fields are of large magnitude.

4. There is either positive experimental evidence that the earth's magnetic field in some completely unknown way affects the homing of pigeons which are in unknown regions or alternately this same evidence indicates that in the Nebraska to Pennsylvania region there is some effect coincidental with the magnetic hypothesis in ultimate effect that causes the peculiar homing of the pigeons in two opposite directions.

5. The homing of birds from territory new to them is of a speed and nature that supports the hypothesis of the birds wandering until known visual references are located.

6. The navigation of birds over territory previously visited or territory which visually releases inherited behavior patterns seems to be adequately accounted for by apparently acute ability to choose the correct flight direction and procedure from memory or inheritance after visual landmark recognition so as to fly from landmark to landmark and to follow geographical lines such as coast lines and rivers. Two effects permit them to maintain flight direction between landmarks: (a) Birds may maintain their sense of direction apparently just from memory of movements as in fog for short distances at least,

although fog prevents navigation if the bird is initially lost; (b) It is possible that birds can maintain their sense of direction by light compass orientation and by maintaining a constant flight angle with some visual references such as ocean swells.

7. The wandering and visual orientation theory is certainly part of the correct explanation. The magnetic theory is lacking in theory and upheld by experiments which for various detailed reasons need to be repeated. Even if valid magnetic effects exist, that they are anything but grossly inefficient has yet to be shown. The burden of proof still seems to lie with the proponents of the magnetic theory.

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GENERAL NOTES

The type locality of the Olive Warbler.—Dr. John T. Zimmer has recently (Auk, 65: 126–127, 1948) called attention to the fact that *Sylvia olivacea* Giraud is preoccupied and must be replaced by *Sylvia taeniata* Du Bus as the species name of the Olive Warbler. However, as to the type locality I do not believe Dr. Zimmer's designation of "San Pedro, Oaxaca" is correct.

My own examination of the type of *Sylvia taeniata* Du Bus at the Royal Natural History Museum at Brussels in July, 1939, is in substantial accord with the determination by Delacour and Verheyen (Zimmer, *l. c.*) and there can be little doubt of the subspecific identity of the type. The chief point of divergence is that while they considered the type as "greatly faded" my own rather detailed notes consider it as slightly faded but not to an extent as to obscure the color characters. I set forth the data concerning this type in the Wilson Bulletin (54: 212–213, 1942) and on that basis Brodkorb (Auk, 61: 404, 1944) has designated San Cristóbal, Chiapas, as a logical type locality for *Sylvia taeniata* as well as for *Cyanocorax unicolor* Du Bus.

Since Dr. Zimmer obviously has overlooked both of the items above referred to it is not unlikely that others have done the same and such probability has prompted the present note.[1]—A. J. VAN ROSSEM, *University of California, Los Angeles.*

Note on the identity of *Cuculus cornutus* L.—In his Systema Naturae, ed. 12: 171, 1766, Linnaeus named a bird *Cuculus cornutus*, basing his description on "Atingacu camucu" of Marcgrave (1648, p. 216) and the accompanying woodcut. In later years, Linnaeus's name has been discarded altogether, after Cabanis and Heine [Museum Heineanum, 4 (1): 89, footnote, 1862] had judged it to be founded on an artefact. This, however, is not so. The original painting which served as a model to the carver is still preserved in the State Library of Berlin (Lib. pict. A. 33) and has been examined by the late Adolf Schneider and myself in 1937. It unmistakably shows a specimen of *Piaya cayana* with several of its crown feathers standing upright. The disorderly position of these feathers apparently fascinated the painter (A. van den Eeckhout), and was later utterly misinterpreted by his copier, the engraver who transformed them into a horn-like structure. This has already been pointed out by my friend Schneider (Jour. für. Orn., 86: 98, 1938), who, however, overlooked the fact of Marcgrave's "Atingacu camucu" having been named by Linnaeus. The north-Brazilian *Piaya cayana pallescens* Cabanis and Heine will thus have to stand as *Piaya cayana cornuta* Linnaeus; type locality, Pernambuco.—ERWIN STRESEMANN, *Zoological Museum, Berlin, Germany.*

Male Hudsonian Chickadee feeds mate in mid-air.—On June 10, 1947, Walter Tholen and I were pulling a boat from Fishing Lake into a beaver pond near the cabin in which we were staying about 75 miles north of Nipawin, Saskatchewan, when we frightened a female Hudsonian Chickadee (*Parus hudsonicus hudsonicus*) from a small, dead white birch (*Betula*). She scolded us with many *Dee-dee-dee-dee-dee* calls and flew from one neighboring willow to another. The stub was about 15 cm. in diameter and the opening, made by the chickadees themselves, was about

[1] Van Rossem (1942) stated that Bonaparte was in error in saying that the type of *Sylvia taeniata* Du Bus came from San Pedro, Oaxaca, as claimed by Bonaparte (1850). Nevertheless, he offered no evidence in support of that statement. I did not designate San Pedro as type locality but accepted Bonaparte's statement at face value. He may have obtained direct information from Du Bus as I suggested in my article, or from Ghiesbreght, the collector of the type. I am quite willing to accept Brodkorb's later amendment if Bonaparte was wrong, but until this is proved, Bonaparte has some ninety-six years priority over Brodkorb.—J. T. ZIMMER.

three centimeters across and 242 cm. above the water in the beaver pond. Inside were five eggs. As we examined the nest, the male was heard approaching, flying from tree to tree until he reached a small willow about eight meters from us. He had a bulging mouthful of insects. The female was in another willow about four meters away. The male continued to give the *Dee-dee-dee-dee-dee* call and suddenly, at exactly the same time, he and his mate left their respective willows to go to the other. They met about three meters above the water and while they maintained their positions by very rapid wing beats, the male gave the complete contents of his bill to his mate which returned to the willow she had just left. Here she alighted, swallowed the food and soon returned to the nest only about one meter from where I was standing in the boat. The male disappeared along the edge of the beaver pond, evidently in search of more food.

The beaver pond, except on the lake side, was surrounded with white spruce and black spruce forests and jack pine ridges. A number of half-living and dead spruce, birch and poplar grew in the shallow areas of the pond. Here Robins and Solitary Sandpipers were found while Lesser Scaup Ducks and Soras nested in the grass and sedge areas near by.—LAWRENCE H. WALKINSHAW, *1703 Central National Tower, Battle Creek, Michigan.*

Mallard nesting in an old Magpie nest.—On May 26, 1947, Dr. Harry Swallow reported to us that a Mallard was nesting in an old Magpie nest. With his assistance we were able to go to the farm of Fred Harris, three miles south of Yorkton, Saskatchewan. Here we found that a Magpie (*Pica pica hudsonia*) had built a nest in a small woodland across the road from the Harris's home. This nest was used by the Magpie during 1945. During 1946 a Mallard (*Anas p. platyrhynchos*) had taken over as recorded in The Blue Jay, the official Bulletin of the Yorkton Natural History Society, Yorkton, Saskatchewan (4 [no. 4]: 42, 1946).

The nest was 12 feet above the ground, in a thick stand of poplar and willow that covered several acres, and was well lined with down built over the stick nest of the Magpie. When we visited it on May 26, 1947 it contained eight eggs. I frightened the female Mallard from the nest and she flew quacking out of the woods. A ninth egg was found broken on the ground near by. Apparently the Mallard had used the nest two successive years.—LAWRENCE H. WALKINSHAW, *1703 Central National Tower, Battle Creek, Michigan.*

Unusual feeding behavior of a Cape May Warbler.—This fall (1947) a Cape May Warbler (*Dendroica tigrina*) spent about two weeks in and around my back yard in Urbana, Illinois. The period of its visit was about September 23 to October 8. At almost any time of day during that period it could be found in or near a willow tree which has for many years been a favorite feeding spot for migrating Yellow-bellied Sapsuckers (*Sphyrapicus varius*). The sapsuckers had drilled a series of small holes in the bark of the willow and spent considerable time feeding there. Whenever the sapsuckers' feeding was interrupted for any cause and the tree was free, the Cape May Warbler immediately moved to the spot and began to climb on the bark from hole to hole draining the sap that could be obtained at each spot. This bird was observed daily for most of the period mentioned, and its visits to the sapsucker borings were noted through field glasses not only by myself but by two other amateur bird-watchers. Between the visits to the sapsucker borings the warbler fed on insects on neighboring elms and grapevines in the usual manner of warblers.—C. S. MARVEL, *University of Illinois, Urbana, Illinois.*

Repeated anting by a Song Sparrow.—During July, 1947, a Song Sparrow was watched at Cold Spring Harbor, Long Island, New York, visiting almost daily a stand of dock (*Rumex*) that was infested with aphids. The bird would hop or fly to one of the large, lower leaves, look around carefully until it saw one of the ants that was attending the aphids, seize it with its bill, and then go through the well-known anting performance. The bird usually did not have a very good hold on the stem of the leaves and threatened to fall off its perch nearly every time. This stand of dock was outside my laboratory window, and it was thus easy for me to check on the repeated visits of the bird. The most striking aspect of the behavior was that the anting seemed almost like part of the bird's daily routine. When approaching the stand of dock the bird acted as if it knew exactly that it would find ants there which would permit it to indulge in anting.—E. Mayr, *American Museum of Natural History, New York, N. Y.*

Gulls feeding on flying ants.—The following observation may be added to the rather scanty reports on gulls feeding on flying insects. On September 2, 1947, between 6:00 and 7:30 p. m., E. S. T., a flock of about 100 Laughing Gulls (*Larus atricilla*) and fifteen Common Terns (*Sterna hirundo*) were wheeling about 100 to 300 feet high above the lawns and gardens around the southeast shore of Cold Spring Harbor Bay, Long Island, New York. The flight behavior of the birds was so peculiar that a number of laymen took notice of it. The birds acted as if they were catching something in the air. Close observation finally revealed that winged males and females of ants (apparently a species of *Lasius*) were hatching simultaneously throughout the area above which the gulls acted so peculiarly. The large winged females flew straight up in the air and it was these that the gulls and terns were catching. The flight area covered a stretch of about half a mile in length. It is estimated that each gull may have caught 100 ants or more during this period.—E. Mayr, *American Museum of Natural History, New York, N. Y.*

Courtship of the Northern Blue Jay.—Tyler, in Bent's 'Life Histories of N. A. Jays, Crows, and Titmice' (1946), says that the literature provides little information on the courtship of *Cyanocitta cristata bromia*. For this reason, and because the performance which I happened to witness differed from those described by Bent, it seems desirable to place the following observation on record.

About 8:30 A. M. on March 30, 1946, at Detroit, Michigan, I noticed two Blue Jays about 60–70 feet up in an old elm. One of them repeatedly hopped straight up and down on the limb, moving rapidly, with 5–12 hops in each series. When the 'hopping' bird came within a few inches of the other and repeated the performance the onlooker flew off. During one such performance the displaying individual pecked once at the limb as it alighted from each hop of the series, and then pecked vigorously and repeatedly at the limb after the completion of the series. No vocalizations were noted.—J. Robert Miller, *1523 E. Jefferson Avenue, Detroit 7, Michigan.*

Nest-robbing behavior of the Purple Martin.—On May 11, 1947, my brother, Wray H. Nicholson, stated to me that he had seen a Purple Martin (*Progne subis subis*), fly into a gourd which had been placed on a pole, and emerge with a tiny young Southern Crested Flycatcher in its bill. Flying away with the tender young nestling, it dropped it a short distance away. It returned again and entered the gourd, and both flycatchers furiously attacked the invader as it stuck its head out of the opening in the gourd, but the martin appeared to be able to fight off the infuriated parents. Mr. Nicholson stated that he saw the martin carry away but one young, but it may have already taken out others so far as he knew. Naturally

the purpose was to evict the flycatchers to enable the invaders to possess this gourd for their own nesting activities. This is the only instance of this character which has come to my attention and I never would have suspected such a peaceful species of such conduct.

I might state here that I have seen numerous instances of the martins dipping into our city lakes as they flew low over the water, but whether to drink or to wet their under parts, or both, I am unable to say. I have seen the Fish Crow repeatedly fly down in the center of a lake and dip its bill in the water (one bird would do this several times), but they did not otherwise touch the water with their bodies, About ten years ago at Tallahassee, Florida, in company with the late Charles E. Doe, I saw a number of Chimney Swifts repeatedly fly over the surface of a large lake, dipping their bodies a number of times and trailing along several yards before arising. Whether merely wetting their bodies or drinking and bathing I cannot be certain.—DONALD J. NICHOLSON, *Orlando, Florida.*

Baltimore Oriole in Florida.—Although I have lived in Florida for 54 years, it was not until April 27, 1947, that I saw and heard my first Baltimore Oriole (*Icterus galbula*) which was noted on the east shore of Lake Washington, Brevard County, Florida. Howell records one bird seen at Eau Gallie, just seven miles away, on April 13, 1910. The bird was a male in full breeding plumage and singing at the time of discovery. Apparently the Baltimore Oriole follows the coast lines during migration, else I certainly would have noted it at some time during all these years.—DONALD J. NICHOLSON, *Orlando, Florida.*

Berry-feeding of the Ring-billed Gull.—In Orlando, Florida, which is about 45 miles inland from the Atlantic Ocean, thousands of Ring-billed Gulls (*Larus delawarensis*) now winter in the city, frequenting the many fresh-water lakes and school grounds, plowed fields, etc. They usually appear the last week in November, but rarely an individual is found by November 15 or 17. They remain until about May 15, but a few birds linger late into June or July.

This gull made its appearance in Orlando after the great storm of 1930 when the hordes of Dovekies were driven as far south as Miami. That year about 50 birds remained all winter, but each year since then they have gradually increased until now several thousand birds regularly return each season. They have become extremely tame as they are fed by the residents, sometimes taking bread from the hands of the feeder. Rarely a few immature Herring Gulls mingle with the Ring-bills, but thus far no mature Herring gulls have been seen. From one to six of the larger gulls are sometimes present, but never more.

On numerous occasions I have noted many gulls hovering over the cabbage palms, plucking ripe fruits, but I have also seen them alight in the palms, with waving wings, trying to balance themselves while they picked the fruits. They have been seen also feeding on the ripe berries of the cherry laurels in the parks. How several thousand sea birds can find sufficient food inland is puzzling, and I suspect that many have rather empty stomachs at times. There is not enough available food in our lakes for large numbers of these birds. The ratio of immature birds to full-plumaged white adults is perhaps around 75%.—DONALD J. NICHOLSON, *Orlando, Florida.*

Loose-feathered birds.—The note in the April, 1948, issue of The Auk, Vol. 65, No. 2, page 300, entitled 'A Loose-feathered Nighthawk,' by G. Hapgood, has prompted me to relate my experience with the Caprimulgidae and other families. In the Washington zoo we have several examples of *Chordeiles virginianus* and the frogmouth (*Podargus cuvieri*). At best they make passive exhibits, but they lend

variety to a collection and depict examples of protective coloration and modifications for an aerial-feeding existence. Whenever it has been necessary for me to handle these birds there was a profuse shedding of feathers, and I recall that many primary feathers were lost. It was necessary to take these birds in hand at frequent intervals and these handlings were not during the period of molt. I am inclined to believe that the shedding or "throwing" of the feathers is a result of a nervous shock caused by handling, as stated by Mr. Parks.

However, a bird that has been a captive for some time may be more or less abnormal in several ways. The physiology of a caged individual is not comparable to that of an equal at liberty. Many of the Columbidae shed their feathers when handled. A small form the Ring-necked Dove (*Turtur risorius*) sheds profusely, as does also the peafowl, in particular the Blue Peafowl (*Pavo cristatus*). One morning I had occasion to catch an Ocellated Turkey (*Agriocharis ocellata*) and treat its injured leg. As I grasped the bird by the back many of the contour feathers littered the floor of the cage.—MALCOLM DAVIS, *The National Zoological Park, Washington, D. C.*

Additional instances of paired ovaries in raptorial birds.—The following notes constitute additions to the author's records on paired ovaries in birds (*see* Auk, 45: 98–99, 1928; and 48: 117–118, 1931). No search of the literature on this subject has been undertaken.

Concerning the Goshawk, *Accipiter gentilis*, only a general statement seems necessary. The frequency of finding paired ovaries in this species suggests that this condition is the rule rather than the exception.

A Golden Eagle, *Aquila chrysaetos*, taken at Lake Opeongo, Algonquin Park, Ontario, on December 3, 1930, was found on dissection to possess paired ovaries. This condition was observed in another example of this species, one taken at Grassy Narrows Lake (an expansion of the English River) in Kenora District on March 15, 1933. A third example in this species concerned a specimen taken at Grassy Narrows Lake in February, 1937. Notes made at the time of dissection state that the right ovary was approximately one-third the size of the left.

A Hawk Owl, *Surnia ulula*, taken at Bloomfield, Prince Edward County, Ontario, on November 23, 1935, was found to possess paired ovaries. The right was very much undeveloped but measured approximately seven millimeters in length, and granulation was readily apparent.

A Great Gray Owl, *Strix nebulosa*, taken at Toronto, Ontario, on February 21, 1947, was found to possess paired ovaries. The right was undeveloped, measuring approximately 3 millimeters in length, but was granular in appearance and two follicles were observed to be distinctly swollen. The more normal left ovary measured nearly twenty millimeters in length.—L. L. SNYDER, *Royal Ontario Museum of Zoology, Toronto.*

Heron mortality caused by *Eustrongylides ignotus*.—On August 31, 1942, I sent to Dr. F. R. Beaudette, Poultry Pathologist at the New Jersey Agricultural Experiment Station, New Brunswick, specimens of larvae taken from a Great Blue Heron, just reaching maturity. The bird had been observed by some boys who were walking along the banks of a stream in the northern outskirts of Newark. It stood on the stream bank and the boys did not note anything wrong with it. On their return a short time later the heron lay dead in the same spot, a "killy" grasped in the bill, which the bird had been too weak to swallow in its last moments.

The boys took the heron to the late Frank Mottram, a retired former taxidermist, who had presented our New Jersey Audubon Society office with many mounted

specimens. He found the body "swarming externally with lice and internally with the parasites, which had eaten through the flesh until in some cases they were puncturing the skin." Although freshly dead when Mottram received it, "the internal parts had largely liquified." Apparently the heron had wallowed in mud just before death and was heavily besmeared. Mr. Mottram cleaned and mounted the heron and constructed the case in which he presented it to the Society. He also sent me the samples of parasites, which were, in turn, submitted to the pathologist for identification.

In the first week of August, 1947, Mr. Charles T. Ragot of Rutherford, N. J., telephoned me one evening asking advice as to the case of a Black-crowned Night Heron he had captured. From his description of conditions, I suspected an infestation of *Eustrongylides ignotus* and urged Mr. Ragot, in case the heron died, to get it into the hands of the pathologist as quickly as possible. The report from the pathologists' office to Mr. Ragot, under date of August 8, 1947 reads:

"The bird which you sent to our laboratory died of a verminous peritonitis. The intestines were pierced in many places by a worm which resembles Eustrongylides ignotus. As a result of this it was impossible for any food to pass through the intestinal canal and adhesions bound the intestines together to an extent that it was impossible to dissect them free without cutting the worms. In addition, an unidentified fluke was found in the esophagus."

Apparently herons become infested with this parasite through eating infested fish, the natural host of *Eustrongylides ignotus*.—B. S. Bowdish, *Demarest, New Jersey.*

White-throated or Bat Falcon in Nuevo León, México (Plate 18).—My friend Dr. Edward Fleisher, of the faculty of Brooklyn College, Brooklyn, New York, visited various localities in the State of Nuevo León, México, from February 16 to 28, 1945. From the 19th to the 28th his base was Linares, a locality about 200 kilometers south of the Río Grande (80 kilometers south of Monterrey) along the main México City highway. I had visited this place briefly myself in 1938 and 1939 and had investigated its bird life somewhat more than casually in 1941 (*see* Sutton and Pettingill, 'Birds of Linares and Galeana, Nuevo León, México,' Occ. Pap. Mus. Zool., Louisiana State Univ., No. 16, November 22, 1943). To me the most interesting species Dr. Fleisher discovered in this district was the Bat Falcon or White-throated Falcon, *Falco albigularis* Daudin, a small, handsome bird of prey which I have never seen north of the general vicinity of Victoria, Tamaulipas (*see* Sutton and Burleigh, 'A List of Birds Observed by the 1938 Semple Expedition to Northeastern Mexico,' Occ. Pap. Mus. Zool., Louisiana State Univ., No. 3: 27, April 5, 1939). Dr. Fleisher was fortunate enough to come upon an exceedingly unsuspicious pair of the birds which may have had an eyrie on the railroad bridge which spans the Río Camacho just north of Linares. Here he saw a single bird on February 20 and two birds (more than likely a pair, to judge from the discrepancy in size) on February 23. On the latter date, approaching by way of the bridge itself, he was able to walk within about 30 feet of the birds, which were perched on the cross-bar of a telephone pole. They did not take alarm even when he stopped to look at them directly. The photo was taken with a Contax camera with 135 mm. lens attached. The print here reproduced was made from a Kodachrome transparency.—George Miksch Sutton, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

Egrets nest along Colorado River (Plate 18).—On the Havasu Lake National Wildlife Refuge there are considerable areas between Topock, Mohave County, Arizona, and Needles, San Bernardino County, California, consisting of flooded dead screw bean (*Prosopis pubescens*) and mesquite (*Prosopis juliflora*) brush. The brush

was drowned by rising Colorado River levels, and has been dead for several years. In such brushy areas, during the spring and summer of 1947, not only Double-crested Cormorants (*Phalacrocorax auritus*) and Great Blue Herons (*Ardea herodias*) have nested, but American Egrets (*Casmerodius albus*) and Snowy Egrets (*Leucophoyx thula*) as well. The four species nested in scattered colonies in the low, dead brush. The egrets' nesting is of especial interest, since they have not previously been known to breed in Arizona. (All nests were in Arizona, or so close to the ill-defined state line that they could well be in either state. The Colorado River forms the boundary between Arizona and California.)

American Egret nests were first found April 24, when four were discovered, all containing eggs. The same colony was revisited June 7, at which time five nests, containing young about one-half grown, were found (four of these were those discovered April 24). Four nests contained two young (one nest and young photographed; *see* Plate 18), while the fifth held but one. In the same colony, three Snowy Egret nests were found June 7, one containing four eggs, one two eggs, and the third three downy young perhaps ten days old.

A second American Egret colony was found June 8, well over on the Arizona side of the refuge. This colony consisted of four nests, two of them holding two young about one-third grown, and the remaining two holding three downy young each.

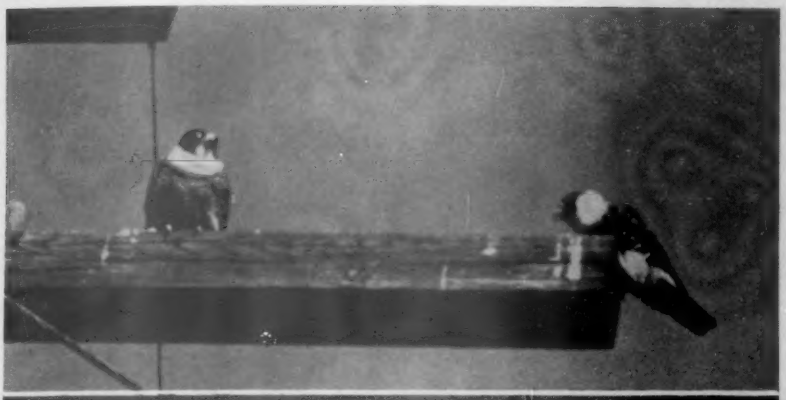
Since not many Great Blue Heron nests have been found in Arizona, a colony of at least fifty nests in this same area is perhaps worthy of note.

A recent report (Sprunt, Auk, 59: 586, 1942) of American Egrets allegedly nesting at Mormon Lake in northern Arizona, should be dismissed for lack of suitable evidence.—GALE MONSON, *Fish and Wildlife Service, Parker, Arizona.*

Another Common Tern nest with seven eggs (Plate 18).—In the July, 1947, issue of The Auk was published a note and photograph by Frederick E. Warburton of Owen Sound, Ontario, concerning a nest of the Common Tern (*Sterna hirundo*) containing seven eggs. Mr. Warburton's photograph actually showed only six eggs, but in his note he explained that one had disappeared before the photograph was taken. The phenomenon of seven eggs in a single Common Tern's nest may be less rare than Mr. Warburton thinks. On July 5 of this year (1947) I came on a similar nest on the sandbar south of Holgate, New Jersey, where there is a large colony of Common and Least Terns, and some Black Skimmers. As I had my camera with me at the time I was able to photograph it immediately.

Like Mr. Warburton, I cannot say for certain whether all seven eggs were laid and were being incubated by one bird or not, for my presence created the usual commotion and excitement among the terns and skimmers and I was not able to wait until all the inhabitants of the colony had again settled down on their nests. But the eggs in the unusual nest were all warm, despite the fact that it was late in the day and the sun was already low in the sky. Furthermore, in view of the remoteness of the colony, I doubt whether some jokester had combined the eggs of two nests in one, although the possibility of course exists. Unfortunately, as I live far from Holgate, I was unable to visit the nest again.

In view of the reported discovery of two nests of the Common Tern, in widely separated breeding areas, and in different years, each containing seven eggs, I should think it worth while for field ornithologists to keep an eye out for the phenomenon whenever they visit a tern colony, and, if they come on such a nest again, make a point of keeping it under observation until they have been able to establish definitely whether or not it is being incubated. It might even be interesting to continue the



(*Top*) SUTTON: BAT FALCON, NUEVO LEÓN, MÉXICO. (*Middle*) MONSON: AMERICAN EGRET ALONG COLORADO RIVER. (*Bottom*) FRY: COMMON TERN NEST WITH SEVEN EGGS.

observation until the eggs have hatched and report the behavior of the parent birds toward the chicks.—VARIAN FRY, *45 East 49 St., New York, N. Y.*

Western Grebe at Owen Sound, Ontario.—On May 16, 1947, I saw a Western Grebe (*Aechmophorus occidentalis*) on the Sydenham River just below Harrison Park, Owen Sound. When first seen the bird was swimming about 100 yards away, with just its head and neck above the surface of the water. It dived quickly when I attempted to approach more closely by canoe, reappearing a little farther away and diving almost immediately. On these and subsequent appearances, however, I had several excellent opportunities to observe the bird through my binoculars. The long, sinuous neck, slightly crested head, black crown and hind-neck, white cheeks and fore-neck, light-colored and slightly upturned beak, and obvious grebe actions would seem to make its identification as this species unquestionable.

Dr. A. L. Rand informs me that ". . . the 1931 A. O. U. Check-List gives this species as 'casual in Ontario (?)'. However, there is an old record from Sarnia, a specimen taken by Saunders and reported on in the Ottawa Naturalist, 27, 1913, p. 76, and in the 1947 Auk, Vol. 64, p. 144 is a note of the species occurring in Massachusetts."

It would appear, therefore, that the Western Grebe occasionally straggles eastward from its prairie breeding range to the New England coast but is rarely recorded from Ontario.—FRED WARBURTON, *444 Second Ave., East, Owen Sound, Ontario.*

Yellow-headed Blackbird on Long Island.—Because the Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*) is ordinarily restricted to the marshes and swamps of western United States, the occurrence of even a single individual on Long Island, New York, seems to be worth reporting.

At his home in Blue Point, Long Island, approximately 55 miles east of New York City, U. S. Game Management Agent, Samuel T. Miller, maintained a small bird-feeding stand last winter (1946–1947). On the lawn and grounds about his home he strewed corn and wheat. On April 17, 1947, a flock of about 15 or 20 Red-winged Blackbirds appeared on the lawn, and with them came a single male Yellow-headed Blackbird, brightly colored, and showing a conspicuous white wing patch. For more than ten minutes Mr. Miller watched this bird feeding, frequently within 10 or 15 feet of the window. This particular bird seemed much more nervous than the rest of the flock. Because of the distinctive color markings and Mr. Miller's knowledge of birds, there seems to be no question about the accuracy of the identification.—Dr. CLARENCE COTTAM, *Fish and Wildlife Service, Chicago, Illinois.*

Surf-bird and Vermilion Flycatcher in Panamá.—On a recent visit to Panamá there were observed two species previously unrecorded from that country or apparently from southern Central America.

On August 14, 1947, while examining the numerous waders feeding on the flats and rock ledges exposed at low tide in Panamá Bay, just west of the ruins of Old Panamá, I noted four birds, somewhat resembling turnstones but with more plover-like bills and with upper parts, head, neck, and breast giving a uniform dark gray effect, which were obviously Surf-birds (*Aphriza virgata*). This identification was confirmed when they were flushed and exposed a white tail with a black terminal band and a conspicuous white wing band. As the Surf-bird winters on the Pacific coast of South America, its occurrence in Panamá is not surprising, even though there seems to be no record for it in Central America south of Guatemala (Griscom, Bull. Amer. Mus. Nat. Hist., 64: 129, 1932).

On August 19, 1947, at Playa Coronado, a beach cottage development on the Gulf of Panamá, about forty miles west of the city of Panamá and four miles from the village of Chame, I found a brilliant male Vermilion Flycatcher (*Pyrocephalus rubinus*), perched on a low barbed-wire fence in front of a house perhaps a hundred yards from the beach. The bird, which had not been noted during the previous days of my visit, and was not present on any subsequent day, spent the whole afternoon in the same locality. No other Vermilion Flycatcher was seen, though the avifauna of the vicinity was repeatedly inventoried. Playa Coronado is situated in a region of low scrubby woodland interspersed with small grassy areas, which become more extensive some miles westward, finally merging with the scrub-dotted open grasslands of Coclé Province. While the Vermilion Flycatcher ranges from the southwestern United States to Guatemala and the Caribbean slope of Honduras, and reappears in Colombia and Venezuela, breeding through the more open areas of South America, it seems to be unknown in southern Central America (Hellmayr, Field Mus. Nat. Hist., Zool. Ser., 13 [pt. 5]: 93, 1927; Griscom, Bull. Amer. Mus. Nat. Hist., 64: 247, 1932). Whether this individual was a migrant or an accidental, or came from some unknown breeding colony in Panamá remains uncertain. As I had no means of collecting the bird (although I was near enough to secure a tiny but recognizable image on 8mm. kodachrome motion picture film), it was not possible to determine the subspecies involved.—Eugene Eisenmann, *Linnaean Society of New York, New York, N. Y.*

Four species of chickadees in Glacier National Park.—Northwest Montana is the only area in the United States where the ranges of all of the four distinctively marked species of chickadees overlap. Despite this fact, however, only two of these, the Black-capped (*Parus atricapillus*) and Mountain (*P. gambeli*) Chickadees, have been definitely recorded from Glacier National Park, within this area ('Checklist of the Birds of the National Parks,' Wash., D. C., 1937, mimeogr.). F. M. Bailey ('Wild Animals of Glacier National Park,' Washington, D. C., 1918) additionally caught a glimpse of what appeared to her to be a Chestnut-backed Chickadee (*P. rufescens*) near Lake McDonald and listed this species with a question mark. In view of the limited recorded observations to date and the complications of collecting in a national park, the following 1947 sight records for the park are presented. They may at least be helpful to later investigators.

Among a mixed flock of Black-capped and Mountain Chickadees, one Chestnut-backed was definitely identified at close range about half way up Avalanche Creek on July 20. Two others were seen in a similar mixed flock along upper Sprague Creek on July 30. These birds had distinct black caps which contrasted sharply with their brown backs. Both locations were on the west slope of the Lewis Range, along the crest of which runs the Continental Divide. On August 20, a lone Hudsonian Chickadee (*P. hudsonicus*) was observed closely among a large flock of Creepers (*Certhia familiaris*) on the south side of Two Medicine Lake, on the east side of the Divide.

Typically, the common Black-capped Chickadees in the park appeared to prefer portions of the cedar-hemlock and Douglas fir-larch-lodgepole pine forests broken by shrubby openings, as along streams. Mountain Chickadees were found in all of the park's coniferous forest types, but especially in the Engelmann spruce-alpine fir association. The Chestnut-backed Chickadee seemed to be associated with the cedar-hemlock forest; the eastward extensions of the ranges of both the bird and dominant plant species showed striking similarities. The one Hudsonian Chickadee

was seen in a Douglas fir-lodgepole pine forest, a common plant association on the east slope of the Lewis Range. Further geographic and ecological distributional notes and breeding data are needed for all the species of chickadees occurring in the park.—GEORGE A. PETRIDES, *Ohio Cooperative Wildlife Research Unit, Ohio State University, Columbus 10, Ohio.*

Stilt Sandpiper and Caspian Tern at Lexington, Virginia.—On October 13, 1947, I saw a Stilt Sandpiper (*Micropalama himantopus*) at close range at Cameron's Pond, about a mile north of Lexington, Virginia, I checked all the identification marks, including the note. There is only one former record for western Virginia, a bird seen by A. O. English at Roanoke, September 8, 1940 (The Raven, 12: 19, 1941); and few for the State. There are two Virginia records for the Washington, D. C., region and one for Cobb's Island (The Auk, 50: 195, 1933). Dr. Locke L. Mackenzie saw three at Norfolk, August 25, 1944; and on August 28, 1944, he and Dr. John H. Grey collected a male and a female and saw a third individual at the same place (The Raven, 15: 84, 1944).

On October 13, 1947, I collected a Caspian Tern (*Hydroprogne caspia*) at a small fish pond, one mile east of Lexington, Virginia. It was a male in poor flesh, weighing twenty-one ounces. On the previous day I had seen one on James River, at Waugh, in Bedford County, Virginia. The only previous record west of the Blue Ridge in Virginia is that of two birds seen by the C. O. Handleys, Sr. and Jr., at Blacksburg, September 17, 1945 (The Raven, 16: 77, 1945). The bird is casual at Washington. The only other inland Virginia record of which I have knowledge is that of eleven seen by Prof. Ruskin S. Freer at Timberlake, near Lynchburg, April 24, 1941 (The Raven, 12: 64, 1941).—J. J. MURRAY, *Lexington Presbyterian Church, Lexington, Virginia.*

Cape May Warbler breeding in New York State.—On July 4, 1947, the writers explored an area about one-half square mile in extent of tall coniferous trees, particularly black spruce, in North Elba Township, Essex County, New York. The locality is 1900 feet above sea level and is near the high Adirondack Mountains. We were surprised to find an adult female Cape May Warbler (*Dendroica tigrina*). The small, evenly distributed streaks on the light yellow breast and the characteristic pale yellow cheek areas were observed at leisure. The bird moved actively around, holding food in the bill, and was found to be giving it to two young standing in branches of black spruce trees.

According to Forbush ('Birds of Massachusetts and Other New England States,' part 3, 1929) this species is a summer resident in New Hampshire north of the White Mountains, and has been seen feeding young in Vermont. Our observation is, as far as we know, the first evidence of breeding in New York State.—GEOFFREY CARLETON AND HUSTACE H. POOR, *Linnaean Society of New York,* AND DR. OLIVER K. SCOTT, *Cleveland, Ohio.*

The Dickcissel on the east coast of Florida.—On September 28, 1947, I flushed a Dickcissel, *Spiza americana,* from short grass on an abandoned golf course inside the city limits of St. Augustine, Florida. The bird, after several stops in the grass, flew to a small tree. It was a female. Dickcissels occur in west Florida, and at least one was collected near Panama City last year, but there seem to be few if any previous records from the east coast. September 28 was the second day of a period of more than 48 hours of heavy northeast gales accompanied by some rain.—CLIFFORD H. PANGBURN, *St. Augustine, Florida.*

Hurricane in southern Florida brings rarities to northern part of state.—The severe hurricane which crossed south Florida September 17–18, 1947, resulted in gale winds, overcast skies, and brief but frequently heavy showers on the northern portion of the state's east coast. On September 18 the wind, according to local airport instruments, averaged about 45 MPH, with gusts going to 50 MPH or better. On the date I twice visited a causeway ten miles south of St. Augustine, my first stop being at just about the time the center of the hurricane was passing due south, but about 280 miles distant. This road crosses a large area of grassy salt meadows and mud flats on which considerable numbers of water and marsh birds feed. The excessively high tide which accompanies hurricanes had flooded the entire area except the road, which is of sand and little travelled.

The high water, together with the gale which was almost directly from the south, caused a large concentration of shore birds along this road, together with a few terns and skimmers. The birds had difficulty in walking or even standing in the wind. They were evidently tired and were so reluctant to take wing that by moving slowly I was able to put my car within 15 feet of many, and in some instances was able to drive alongside and within a yard of ordinarily timid species. Some interesting rarities are listed below. While these were sight observations they were made at distances tantamount to having the birds in my hand.

Although not of hurricane strength, a second storm five days later produced at St. Augustine about 36 hours of winds as heavy as those of September 18. These winds reached maximum on the afternoon of September 23, and conditions on the above-mentioned road were similar, but several additional species were observed. These brought the total of shore birds observed on the two days to 24 species, a notable percentage of the possibilities in Florida. Only two Sooty Terns were present on the 23rd.

GOLDEN PLOVER, *Pluvialis dominica dominica*.—On September 23 three Golden Plovers circled around my car. One alighted and remained in the road for an hour. It was more nervous than the other species, but allowed reasonably close approach. Howell lists this species a "very rare or accidental migrant."

BAIRD'S SANDPIPER, *Erolia bairdi*.—Six Baird's Sandpipers were among the flocks of shore birds on the road. Howell in his 'Florida Bird Life' reports this as a rare species in the state.

NORTHERN PHALAROPE, *Lobipes lobatus*.—At least two Northern Phalaropes were noted at close range, and other birds seen at a considerable distance I believe were of this species. Howell lists only two records, one of which was 40 miles south of the point where I saw the birds. One September 23 two Northern Phalaropes were swimming in shallow water within 40 feet of my car. They remained there for an hour, and were still feeding when I left.

SOOTY TERN, *Sterna fuscata*.—About noon I saw eight of these tropical terns, and on my return in the afternoon found 18 in view at one time. They appeared to be exhausted, and on several occasions settled on ground at the road edge in the lee of my car. One I almost picked up in my hand. Four more were noted on a flat seven miles to the north. Howell reports that this species was recorded twice by Longstreet at Daytona Beach, 40 miles to the south, once on the identical date 21 years earlier.

CABOT'S TERN, *Thalasseus sandvicensis acuflavida*.—On my first visit to the causeway a Cabot's Tern alighted in the road about ten feet in front of my parked car. It stood there until I drove away. In the afternoon the same bird, presum-

ably, was on a near-by mud bank from which the water had receded. Howell reports only one record for Cabot's Tern from the east coast of Florida—three birds seen by Wetmore, February 14, 1919.

It was an odd fact that not once during my two trips to the causeway, or while there, did I see any gulls of any species.

No noticeable movement of land birds was taking place at this time, and I noted no effect of the storm on such birds, except for a few wind-blown flocks of Eastern Kingbirds.—CLIFFORD H. PANGBURN, *St. Augustine, Florida.*

Chuck-will's-widow at Norman, Indiana.—Excluding the records of Robert Ridgway as published by Amos W. Butler, in 'Birds of Indiana,' 846–847, 1897, and the latter's note in The Auk, 46: 236–237, 1929, giving details on the 1878 and 1908 records of the Chuck-will's-widow in Knox County and at Indianapolis, respectively, there are no published records for Indiana, not even recent ones, although there are two recent unpublished ones. In view of the scarcity of records and the possibility that the species may be extending its range, it is well that every observation for the State be published. Shortly after dusk on the nights of July 17, 18, 24 and 25, 1947, it was my good fortune to hear a single Chuck-will's-widow uttering its calls from a deep hollow in a deciduous woodland a mile northwest of Norman, Indiana. This small village is 850 feet above sea level and is situated in the western part of Jackson County in the Norman Upland and in the Driftless Area of the State. Due to the lateness in the season, the bird did not utter its characteristic call more than eight times while under observation, and had I not been within hearing distance and listening for it at the appropriate time, shortly after the Whip-poor-wills had started calling, I would have missed the "chuck's" call on account of the more numerous calls of its cousin, the Whip-poor-will. Although the bird was heard calling from the same hollow and woodland on the four occasions just as if it had a territory and was nesting, observations at this late date would not be convincing. Olin Hegwood, a resident of Norman for many years told me that he had heard the calls of a strange night bird for several years. This strange bird might well have been the Chuck-will's-widow. Future field work in the area at the appropriate time might reveal a colony of nesting birds and the first nesting record for the unglaciated, south-central part of the State.—RAYMOND J. FLEETWOOD, *Fish and Wildlife Service, Folkston, Georgia.*

Wilson's Phalarope near Washington, D. C.—On September 8, 1947, I was bass fishing on Tridelphia Lake in Montgomery County, Maryland, just twenty miles from Washington, D. C. Suddenly a small bird arose from the water about a hundred yards from the boat, flew a short distance and alighted. This was repeated a number of times. It swam buoyantly and busily picked some minute substances from the water. I identified it as a Wilson's Phalarope, *Steganopus tricolor.*

I had no gun with me, and hence could not collect it, but any phalarope around Washington was certainly a rare bird. Accordingly the next best thing was to see how near I could get with my small boat. To my surprise it allowed me to approach within five feet by rowing very slowly and carefully. It showed no alarm at my near presence, but kept on busily feeding, uttering only an occasional "chirp." At length it became alarmed, took wing, and settled again about a hundred yards away, whereupon I again went through the same procedure. I could have caught it with a crab net several times. Observation at such a short distance could of course leave no doubt as to identity. The only other record for this bird near Washington is a sight record by Wetmore at Dickerson, Montgomery County, Maryland, on May 12, 1929, as reported in the Auk, 46: 538, 1939.

Washington ornithologists set a twenty-mile limit for local records. Dickerson is farther than that, which leaves the present record as the first one for this bird in the District of Columbia.—EDWIN M. HASBROUCK, *Washington, D. C.*

Gadwall breeding on Long Island, New York.—The status of the Gadwall (*Anas streperus*) up to the year 1946 is well defined by Cruickshank (Birds Around New York City, 1942): "To-day the Gadwall is an uncommon but regular transient and winter visitant on Long Island, being confined chiefly to a few favored fresh-water localities, such as Dean's Sanctuary on the Carmen River at South Haven . . . away from Long Island it is a much rarer bird . . . One may well go for an entire year without seeing the bird locally."

During August and September of 1946, two Gadwalls were present at Jones Beach, Long Island. This occurrence is not at variance with the records, however. From November, 1946, until the end of January, 1947, Gadwalls were seen at two other localities on eastern Long Island, in small numbers. A visit to Dean's Sanctuary on December 29, 1946, revealed that a fair number of Gadwalls were wintering in central Long Island, while their wintering on eastern Long Island was a new aspect in the distribution of the species.

In late March, Gadwalls appeared at Jones Beach sanctuary pond, and in May a few birds were noted at Oak Island, ten miles to the east. To get a clear picture of the distribution of the Gadwall, the authors' notes were tabulated.

1946

Oct.	6—	2, Jones Beach
Oct.	20—	2, Jones Beach
Nov.	7—	7, Valley Stream and Rosedale
Nov.	24—	7, Valley Stream and Rosedale
Dec.	1—	7, Valley Stream and Rosedale
Dec.	8—	8, Valley Stream and Rosedale
Dec.	29—30,	Dean's Sanctuary

1947

Jan.	1—	6, Valley Stream
Jan.	19—	5, Valley Stream
March	30—	4, Jones Beach
April	12—	2, Jones Beach (a pair)
April	26—	6, Jones Beach
May	4—	7, Jones Beach; 2, Oak Island
May	11—	8 including an albino female, Jones Beach
May	17—	2, Jones Beach
May	25—	9, Jones Beach
June	1—	8 (pairs performing), Jones Beach
June	15—	8 (pairs performing), Jones Beach
June	22—	12 (with 13 young), Jones Beach
July	13—	15 (40 young), Jones Beach
July	20—	18 (52 young), Jones Beach
July	27—	9 (54 young), Jones Beach
August	3—	8 (50 young), Jones Beach

Discussion

The strength of numbers that built up at Jones Beach from April on, indicates that there was a definite attraction to the area, and that it was no isolated instance of a

haphazard or accidental population. Though we carefully counted the adult birds during May, we never saw as many birds present as when, during June and July, there were great numbers of young on the pond. Perhaps the breeding birds came from their secretive nests, and swelled the population. The albino bird, a female, was of the palest 'cafe-au-lait' color, though the speculum was apparent and white, when the bird flew. This bird raised a brood of young, none of which showed the least differences from other near-by broods of young Gadwalls. In early June, the pairs were going through some of the mating phases, as the males were seen chasing females the length of the pond, landing and splashing about. It was, therefore, a great surprise when we noted, a few days afterward, young birds on the pond. In May and June, suspecting that the Gadwalls might be breeding, the authors combed the shores of the pond in likely areas but with no luck, outside of frightening a female from the grassy edge of the pond. To ascertain that the ducklings were the young of the Gadwall, we watched the protecting female bird, but as the females were very wary and quiet, it took many hours of careful watching to see the bird finally raise its wings and show the white speculums. The first brood had a male and female in attendance, but as we wanted to be sure that the male Gadwall was not cross-breeding with a female Mallard, the time spent was considered well worth while. Except for the first pair, none of the males were seen near the females or young. The males were usually flushed up in a part of the pond that had neither females nor ducklings. When the young were in large numbers, it was found that they were left to be shepherded with a few females. On several occasions, a female Gadwall flew from her young and landed quite close to the observers, where it would try to divert us by flapping on the water, splashing and quacking, while following our movements up and down the edge of the pond. On July 13, 1947, while leaving the pond, we saw three or four very young ducks trying to cross the concrete road in the direction of the pond. The ducklings were coming from the ocean side of the road and were about 50 yards from the ocean, while over 150 yards from the pond. There was no water present on the ocean side of the road other than the ocean. Kortright (The Ducks, Geese and Swans of North America, 1942) has this to say about the nesting habits of the Gadwall: " . . . always on dry ground and never near water." Possibly the mystery of the hidden nests was partially solved. We should have looked just back of the dunes on the beach for the nests, and not on the rim of the pond. The young hatched out through two weeks, and the size differences were apparent when we were counting the young. Females and young judiciously stayed in the middle of the pond and were rarely seen near any of the shores while we watched.

This breeding record constitutes the first for this species in New York State. Dr. A. A. Allen of Cornell University states, in a letter to the authors dated August 2, 1947: "We have no breeding records for central New York." However, on consulting the literature of the year 1946, we were not too surprised about the Gadwalls breeding on Long Island, for in a note, "Nesting of Gadwall and Shoveler on the Middle Atlantic Coast" (Auk, 63: 436–438, 1946), R. E. Griffith and John Herholdt write of the Gadwall breeding at Pea Island Refuge, Dare Co., North Carolina, from 1939 until 1945, while it also nested at Bombay Hook Refuge, Kent Co., Delaware, during the same years.

The further extension of a species which, until recently, had never been known to breed east of the Mississippi, makes one wonder about this western waterfowl. Is it that the nesting areas are gone, and are being threatened, and that the pressures are so great that the species has spread out to find new nesting territories? Or (in a

purely suppositional frame of mind) are they coming back to nesting grounds that they held in pre-colonial or colonial days, where because of their resemblance to other commoner ducks, they were overlooked in the multiplicity of water fowl of that time? We cannot answer these questions presently, but the former postulation may be proven, in a sense, if more of the purely western species seek and find breeding grounds on the Atlantic coast.

In 1948, the Gadwalls are back again at Jones Beach, having been seen since the middle of March.—WALTER SEDWITZ, *24 West 76 Street, New York, City;* IRWIN ALPERIN; AND DR. MALCOLM JACOBSON.

First Long Island breeding record of the Brown Creeper.—The Brown Creeper (*Certhia familiaris americana*) has been recorded nesting in northern New Jersey (Cruickshank, 'Birds Around New York City': 327–328, 1944). Up to the present time, however, there has been no confirmed record of its nesting on Long Island. The following observations on a pair nesting at Smithtown, Long Island, seem worth recording.

On April 14 and again on May 1, 1947, my eight-year-old nephew reported a pair of creepers nesting on a tree six feet from the edge of a much used driveway on the David Weld farm, Smithtown. On May 15 these reports were confirmed by the writer. The nest was located 53.5 inches above the ground on the southeast side of a large yellow locust (*Robinia pseudacacia*) beneath a large slab of loose bark. One bird was sitting on the nest. This bird was disturbed and shortly a pair appeared in the vicinity. They were completely silent. The nest contained five eggs. In conversation with the children, who had been subjecting the nest to frequent inspections, we deduced that these eggs were probably deposited about May 1.

On June 6 the nesting site was again inspected by the writer. It was empty. Conversation with the children indicated that the birds left the nest about May 23. At this time (June 6) the writer noted several (certainly three, possibly five) apparently young birds in the vicinity of the nest. They were exceedingly shy but apparently were being fed by at least one adult bird.

On June 8 a second creeper's nest was inspected (again in response to advices from the children). It was completely constructed, being just 53.5 inches above the ground on the southern side of a large yellow locust at the edge of the same driveway and about 100 feet to the south of the first nest. It contained no eggs. Two birds were in the immediate vicinity; both were silent.

On June 13 this second nest was inspected again; five eggs were noted. Two birds were seen in the vicinity, both silent and more shy than heretofore.

From June 13 to July 13 this nest was subjected to frequent inspections by the children and was once visited by a cat, the ultimate result being that it was empty and out of shape when last inspection was made by the writer on July 13. It appeared that the second brood was destroyed, though this can not be confirmed beyond a doubt.

In connection with the above it is also of interest to include observations of Dr. Ernst Mayr on probable breeding of the same species at Cold Spring Harbor, 15 miles west of Smithtown on the north shore of Long Island, during the same season. We quote the following from Dr. Mayr's letter concerning a singing male Brown Creeper, which he observed at Cold Spring Harbor on June 18, 1947:

"I had no doubt that the bird was breeding there. This is particularly true since the bird was on a locust tree which I had found in Germany to be a favorite nesting place of the genus. However, when I returned to Cold Spring Harbor on June 26 I saw no trace of the bird, neither did I see it during the rest of the summer,

although I spent hours in the various locust groves looking for the bird. I am sure I would not have missed it if it were there since I am familiar with the characteristic song. I do not have the faintest notion what happened to the bird between June 18 and June 26. I never saw more than the single singing bird. I wouldn't be surprised if the birds had been nesting in one of the locust trees since there were several accumulations of materials under the slabs of loose bark that could have been old nests of the species. However, I am fairly certain that there was no second brood in this locality. A second brood is normal in this species, as I found in New Brunswick in 1933."

It is considered that the exceedingly late spring on Long Island in 1947 may have accounted for the breeding of these birds at an unaccustomed and southerly station. The last frost in the Smithtown area was on May 9. It is also interesting that these birds chose a nesting site in an exposed and slightly elevated position, surrounded by lawns and scattered ornamental trees (principally Norway spruce) in preference to heavily wooded (deciduous), depressed, swampy ground surrounding the 20 or 30 acres of elevated "parked" land.—DAVID G. NICHOLS, *181 Liberty Ave., Westbury, N. Y.*

Painted Redstart in Massachusetts.—On October 18, 1947, while casually birding at Marblehead Neck, Massachusetts, Mrs. Heyliger de Windt, of Boston, and Mrs. David H. Searle, of Marblehead, were attracted to a small bird, strikingly marked in black, white, and bright red, that was actively feeding in a tree above them. It was a species entirely new to them, and examination of their eastern bird books on returning home failed to place it. The bird was watched intermittently in the same neighborhood over a five-hour period, and every detail of color and marking was noted. A call to the executive director of the Massachusetts Audubon Society and a further check on the bird by the discoverers and by Herbert Caswell, of the Essex County Ornithological Club, Salem, identified the visitor as a Painted Redstart. The bird was still present in the same area the following day, when it was observed by Ludlow Griscom, of the Museum of Comparative Zoölogy at Harvard University, and many parties of bird enthusiasts, including fifty members of the Massachusetts Audubon Society on a regularly scheduled field trip.

In the Audubon party, a graduate student at Harvard, who was equipped with a motion picture camera having a telephoto lens, secured motion pictures in color of this western species as it posed obligingly for minutes between its active feeding and preening periods. The bird was last seen in mid-afternoon of that day.

As far as can be determined by the records, this is the first occurrence of the Painted Redstart in the United States outside of its usual range, which includes Arizona, New Mexico, and the Chisos Mountains of western Texas, except for somewhat recent reports of the species from southern California. How the bird happened to reach New England must remain a mystery, though other western and southwestern species have been reported in increasing numbers in recent years. The possibility of its being an escaped cage bird seems remote, since birds with food habits of the warblers are seldom caged, even by cage-bird enthusiasts living in México and Cuba.—C. RUSSELL MASON, *Massachusetts Audubon Society, Boston, Massachusetts.*

Bell's Vireo in Connecticut.—On the morning of May 11, 1947, the undersigned made a field identification of Bell's Vireo in Redding, Connecticut. The day was clear and sunny, with a light wind. A series of observations by all three observers was made over a period of not less than twenty minutes. The bird was seen

from all angles in excellent light and in many postures including that of singing. The observations were made principally from the crest of a shallow gully while the bird was feeding over the stream running through the hollow. At times it was at the eye level of the observers, at times below it, and at other times in tops of small trees which, growing from the bottom of the gully, reached their maximum height slightly above eye level. The bird was occupied mostly in searching for food in the deliberate manner characteristic of vireos and was seen to capture one large green worm about an inch long from the under side of a newly opened leaf. Attention was first attracted to the bird by hearing a part of its song which led the observers to suspect that they had perhaps heard a weak outcry from a Crested Flycatcher. Very shortly thereafter the bird was first observed; the light yellow Flanks were particularly prominent as it turned in the sun. The upper parts may be described as olive green, shading towards brownish gray on the head and showing two light-colored wing-bars. Under parts and breast were washed with yellow but not as bright in tone as the flanks. Throat grayish white; eye dark. Under certain light conditions a light line through the eye was perceptible but not clearly defined. The iris was so dark as to appear black.

Towards the close of the observation the bird perched on an exposed twig and uttered a brief explosive song, the first syllables of which were barely audible, although the throat could be seen to vibrate. Following the half-audible opening notes, the song broke into a whistle not unlike the sound made by a toy steam engine when for a brief moment the valve is opened. The song then died away in a few weak sputterings. At the conclusion of the performance the bird flew farther downstream and the observers felt that no further gain was to be anticipated by following it.—Reuben J. Ross, Francis A. Young, and John A. Young, *Wilton, Connecticut.*

Scissor-tailed Flycatcher in the Chicago area.—On May 3, 1947, a Scissor-tailed Flycatcher (*Muscivora forficata*) was identified by Mr. and Mrs. Albert L. Campbell and Mrs. Amy G. Baldwin at Wolf Lake, Indiana, about a quarter of a mile from the Illinois state line. This bird was watched for half an hour, frequently at distances of not more than 25 and 30 feet. While it was feeding on flies, over a cinder fill adjacent to the lake, ample opportunity was afforded to observe the long tail as well as the pink sides and under lining of the wings, when the wings were being folded. This flycatcher was present next day and was seen by seven other members of the Chicago Ornithological Society, including the writer. A heavy gale had been blowing from the south on May 3 and may have assisted this bird in its wanderings north and east of its normal range. This appears to be the third record for the Chicago area. One was seen at La Grange, Cook County, Ill., April 22, 1902 (Craigmile) and the other was seen in Lincoln Park, Chicago, on May 20, 1933 (Dreuth).—Karl E. Bartel, *2528 W. Collins St., Blue Island, Illinois.*

The names of the Chilean parrots.—In the central part of Chile there are three recognized species of parrots. These three species were first described and named by Molina in 1782 (4).

At the present time all three of Molina's names for these birds have been discarded by ornithologists. The inaccuracy of the descriptions is the principal reason for their not being retained. The late Dr. Charles E. Hellmayr in his book 'The birds of Chile' (3), in speaking of *Microsittace ferruginea minor* Chapman (*Psittacus jaguilma* of Molina), says (note, page 258): "The diagnosis, *'macrurus viridis, remigibus apice fuscis, orbitis fulvis,'* is too indefinite to permit of final conclusion, and the name is better dropped as undeterminable."

Referring to *Enicognathus leptorhynchus* (King), he says (note, page 257): "While admitting that *Psittacus choraeus* of Molina . . . might have been intended for the present species, I do not see how the description, '*Brachyurus* viridis, subtus *cinereus*, orbitis incarnatis,' can be reconciled with its characters."

Concerning *Cyanoliseus patagonus byroni* (J. E. Gray), he says (note, page 255): "It is quite possible, as has been intimated by Barros (Rev. Chil. Hist Nat., **24**: p. 151), that Molina . . . when naming *Psittacus cyanolysios*, had the present species in mind. His description, however, is so faulty that I hesitate to accept the name in the place of Gray's term, which is of unquestionable pertinence."

Deautier and Steullet (2) say: "We believe it impossible, at the present time to establish with certainty the relation of *Psittacus choraus* to the Psittaciformes actually known."

It is evident that the above mentioned authors considered carefully Molina's descriptions and found them so extremely inaccurate that it was well-nigh impossible to reconcile them definitely with the species as we know them. If one takes into account only Molina's descriptions as given in the Methodical Table following the text, then all that has been said concerning the different species is entirely correct and the discarding of the names would certainly be justified; but along with the descriptions we should make a careful study of the text in which the author discusses each species separately.

Before passing judgment on the names used by Molina and whether or not the descriptions actually are correct in every detail, we should consider the circumstances under which the 'History of Chile' was written. First of all we should remember that Molina was an exile from his native land. He had no collections of skins or mounted birds from which to make his descriptions and in all probability they were made entirely from memory. The 'History' did not appear until fifteen years after the author left Chile. We should also remember that at the time the 'History' was written there existed none of the present-day standards of accuracy for scientific descriptions.

It is a general rule, I believe, in considering cases of this kind, that if the species intended by the author can be established beyond reasonable doubt, the original name should be retained.

I am not a Latin student and for the present study I will omit entirely the descriptions of the different species. Had Molina given no descriptions at all, we would have no difficulty in determining to which of the present known species each of Molina's names refers.

In writing of these birds in the text, Molina says (page 211, English edition): "There are three different kinds of parrot in Chili, one of which is constantly to be found in the country, but the other are birds of passage. The first species, called *Thecau* (*psittacus cyanalysios*) is a little larger than a common pigeon. . . . Those which are migratory are the choroi and the jaguilma. I call them migratory, from their inhabiting the Andes in summer, and not appearing in Chili until the winter. . . . The upper part of the body of the choroi (*psittacus choraeus*) is a beautiful green, ... The jaguilma (*psittacus jaguilma*) is entirely green except the edges of the wings, which are brown."

Molina here has given the common names of the three parrots as used in his time. Along with these he has given something of the habits of each one, their abundance, etc., which I have not quoted.

The same three species are still found in central Chile today. None is as abundant as in Molina's time, but most of what he says concerning their habits is true at the

present time. The common names given by Molina are practically the same as those used by the Araucanian Indians in central Chile today. The "Thicau" of Molina is today *Tricau*, the "Jaguilma" is *Raguilma*, and the "Choroi" is still called by that name.

When I first came to Chile in 1902, direct from college and with no special preparation in ornithology, it was my good fortune to spend ten years as an agricultural missionary teacher among the Araucanian Indians. I learned something of their language and really specialized in getting the native names of birds, mammals and plants. At that time the only book I had which gave me any clue to the scientific names of the birds was Molina's 'History of Chili' in English. Knowing the Indian names of the birds, I had no difficulty whatever in recognizing the three species of parrots.

One of the reasons for so easily recognizing them was the fact that Molina, in giving the Latin names, saw fit to retain the common names of two of these parrots as the specific names. The Choroi he called *Psittacus choraeus* and the Jaguilma was *Psittacus jaguilma*. Nothing could be clearer as to the species he intended to name.

This use of the native names for the scientific names of the species described is to me elemental, but it has been completely overlooked or ignored by those discussing Molina's names of these birds. There is no doubt whatever in my mind as to which birds Molina intended to carry the names he gave.

In view of the above I see no reason why Molina's names for all of the three species should not be retained.

The "Tricau," *Psittacus cyanolysios* of Molina became the type for the genus *Cyanoliseus* of Bonaparte. (1) It now becomes *Cyanoliseus cyanolysios* Molina.

Peters and Blake (6) have shown that the other two species now known as *Enicognathus leptorhynchus* (King) and *Microsittace ferrugineus* (P. L. S. Müller) really constitute a single genus, *Enicognathus*.

The species *Enicognathus ferrugineus* P. L. S. Müller has two subspecies, the central form described first by Molina and the southern form described by P. L. S. Müller in 1776 (5), prior to Molina's description.

The four species and sub-species then stand as:

Cyanoliseus cyanolysios (Molina), the "Tricau," Chilean Paroquet.

Enicognathus choraeus (Molina), the "Choroy," Slender-billed Paroquet.

Enicognathus ferrugineus ferrugineus (P. L. S. Müller), "Catita Austral," Tierra del Fuego Paroquet.

Enicognathus ferrugineus jaguilma (Molina), the "Catita chilena," Small Chilean Paroquet.

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2. Deautier, Enrique A., and Steulley, Alfredo B.
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1932. The birds of Chile. Field Mus. Nat. Hist., Zool. Ser., 19 (Publ. 308).
4. Molina, Juan Ignacio
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5. Müller, P. L. S.
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6. Peters, James L., and Blake, Charles H.
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—Dillman S. Bullock, *El Vergel, Angol, Chile.*

RECENT LITERATURE

Birds of Arctic Alaska.[1]—In 1921–1922, the Colorado Museum of Natural History sponsored an expedition to the Arctic coast of Alaska on which Mr. Bailey and the late Russell W. Hendee spent fifteen months collecting birds (and other specimens) for the Museum. Since the expedition, Mr. Bailey has kept in close touch with friends living in the region who have supplied additional material, and he has further explored the literature for records to add to those already in his possession. This report is thus calculated to include all the birds known to occur in that part of the country.

There is a brief, general description of the Arctic coast, a discussion of bird migration in that area, and a historical review of ornithological work there, while the botanical features are detailed by Professor Joseph Ewan of Tulane University. A more comprehensive view of the terrain is to be found in the narrative of the expedition which gives a running account of the experiences of the party throughout the trip.

The birds are then taken up seriatim and discussed principally in respect to their local occurrence. General descriptions of species and of nests and eggs are not included but notes are frequently added concerning special nesting details and activities, or taxonomic features that may have come to attention in the material secured or in published accounts. A number of important problems are pointed out as requiring further study and some answers are suggested as that the Pacific and Green-throated Loons may require specific separation.

The volume is copiously illustrated with many fine photographs of the birds, Alaskan land and seascape, hunting scenes, expedition and other personnel, and some of the exhibition groups prepared from the collections brought back to the Museum.

The book brings together many interesting facts about the birds of an interesting region and is a welcome addition to the literature of the subject, a good bibliography of which is appended.—J. T. Zimmer.

Bent's 'Life Histories.'[2]—Mr. Bent is again to be congratulated on the appearance of a new volume, the sixteenth, in his outstanding series of monographs. As in previous numbers, he has combed a vast quantity of literature for the important facts concerning the life histories of the birds that fill the pages of the book, with the acknowledged aid of an army of contributors who have supplied special information in their possession. Winsor M. Tyler, Alfred O. Gross, Robert S. Woods, Mary M. Erickson, and Alexander Sprunt, Jr., have further contributed one or more of the accounts that are printed under their respective names.

The series is so well known, and appreciatively so, that there is no need to give a detailed review of the present part. Indeed, so much information is contained in the pages that it would be impossible to do so adequately. It is gratifying to be able to record the steady progress of this monumental work.—J. T. Zimmer.

Birds in color.[3]—This book proved to be a great disappointment. When information was received that a volume was in press that would present color-photo-

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[1] Bailey, Alfred M. 'Birds of Arctic Alaska.' 8 vo, pp. 1–317, 101 figs., 1 map. Colorado Museum of Natural History, Popular Series Number 8, April 1, 1948. Price: cloth, $4.50; Paper, $3.00; postage extra.

[2] Bent, Arthur Cleveland. 'Life histories of North American nuthatches, wrens, thrashers, and their allies. U. S. Nat. Mus. Bulletin 195: I–VII, 1–475, pls. 1–90, 1948. Price, $1.75.

[3] Harrison, Hal H. 'American birds in color. Land birds.' Superroyal 8vo, I–XXIV, 1–486, 387 figs. (192 col.), 1948. Wm. H. Wise & Co., Inc., New York. Price [$5.00].

graphs of a wide variety of North American birds, it was hoped that it would be a work of unusual accuracy and value. Unfortunately neither result has been obtained. Some of the many colored illustrations are accurate portraits but most of them either lack adequate detail or have the colors disturbingly false or off-key. The half-tone illustrations are similarly uneven. Some of them are very good but others, particularly the numerous photographs of mounted specimens, have little definitive or pictorial value.

The text is partly descriptive and partly anecdotal, and gives many facts about American birds in an easily readable form. The supplementary chapters with tabulated "Recognition Charts" and "Distribution Charts" contain many misleading or inaccurate placements, such as the Ferruginous Rough-leg among the "black" birds and the Eastern Kingbird among the "black and white striped" ones, the Eastern Hepatic Tanager as a bird of the eastern part of the United States and the Loggerhead Shrike as western. This portion of the book is in need of revision as well as the illustrations.—J. T. Zimmer.

Island Life of Lake Michigan.[1]—The group of islands in northeastern Lake Michigan has offered an unusual opportunity for the study of various problems of considerable interest concerning the distribution of animal species, their ability or failure to occupy certain islands and not others, their means of dispersal, their adaptability to differing local conditions, their success under competition, and the like. Some of these islands have received a certain amount of attention for a hundred years, but it remained for the Cranbrook Institute of Science, in collaboration with the University of Michigan, to undertake a comprehensive survey of the group as a whole. A series of studies was carried out from 1937 to 1944, of which this book presents a detailed report.

The various islands are described as to their topographic and ecological features and something of their past history and altered conditions when important. The report then takes up the herpetology, ornithology, and mammalogy in turn, and closes with a general discussion of the conclusions that have been developed from the study. An appendix gives a list of the land vertebrates arranged by islands. The chapter on birds was prepared by Dr. Van Tyne who was also a member of the field party in 1938.

There is a great deal of interesting information brought out by this study. As far as the birds are concerned, it was found that every island individually (and the group as a whole) was poorer in number of species than the adjacent mainland. Sixteen species that nest on the mainland do not do so on any of the islands and eleven of them were not found there even in migration, while five additional species that migrate over the mainland were likewise not found in the islands. Sixty-seven birds were found breeding on the islands of which six occurred on Beaver Island (the largest of the group) and certain small islands; sixty-one on Beaver and the larger islands, though with scattering single records from one or more of the smaller islets. One of the interesting facts discovered was that the Western House Wren occupies one group of islands and the Eastern House Wren another. A pair of Great Blue Herons and one of Duck Hawks nesting on the ground, Red-wings nesting in trees, and Towhees living in deep forest were among the observed modifications of behavior due obviously to necessity. The greatest variety of bird (and other animal) life was found on islands

[1] Hatt, Robert T.; Van Tyne, Josselyn; Stuart, Laurence C.; Pope, Clifford H.; and Grobman, Arnold B. 'Island Life: A study of the Land Vertebrates of Eastern Lake Michigan.' Cranbrook Institute of Science. Bulletin No. 27. 8vo, pp. i–xi, 1–179, frontisp, figs. 1–43, map, tables 1–15. June 30, 1948. Price, $4.00.

with the greatest ecological diversity, regardless of comparative acreage, although the relationship is not in exact proportion owing probably to differing degrees of adaptability. No positive reason was adduced for the failure of so many mainland species to colonize the islands although the failure was, as might be predicted, less in the birds (13%) than among the other vertebrates.

This brief review will give a general idea of the nature of the discussions presented in this good report. It is stated that conditions for wildlife on the islands are improving owing to lessening human occupancy. It will be interesting to see some future report detailing the changes that may then have occurred. In the mean time there is much interesting and important information in the present account.—J. T. Zimmer.

Birds of the Americas.[1]—This welcome volume adds another number to this comprehensive series, now nearing completion. It was prepared under difficulties owing to the war and to Dr. Hellmayr's untimely death in Europe (*see* **Auk, 61: 616, 1944**), but Mr. Conover has ably brought the manuscripts to final order, having been responsible at first for the text on the Anseriformes (and some other groups that will appear in a later number).

This instalment follows the plan of the previous parts, with the extensive and invaluable synonymic references and the critical footnotes. Mr. Conover's extended studies of the game birds furthermore have made him specially qualified to offer opinions concerning the Anseriformes, some of which are at variance with the arrangements suggested in other recent publications. Among the points of difference from the A. O. U. Check-List and its supplements, seen at first glance, appear the following:

The genera *Querquedula, Chaulelasmus, Eunetta, Nettion, Dafila, Nomonyx,* and *Glaucionetta* maintained as distinct.

Chen hyperborea and *C. atlantica* specifically distinguished, as are ***Melanitta fusca*** and ***M. deglandi***.

Dendrocygna autumnalis fulgens, Anas fulvigula maculosa, A. diazi novimexicana, and *Dafila acuta tzitzihoa* not recognized.

Branta canadensis broken into four species—*leucopareia* (with two subspecies), *minima* and *hutchinsii* (each monotypic), and *canadensis* (with four subspecies, including *parvipes*).

In other orders, *Plegadis chihi* is adopted in place of ***P. mexicanus*** which is considered of doubtful identity.

Phalacrocorax olivaceus mexicanus is considered a subspecies of ***P. brasilianus***.

Ardea occidentalis is made a subspecies of *A. herodias* with ***würdemanni*** and ***wardi*** as synonyms.

Other distinctions will no doubt be evident on closer study, both among the North American species and those of the more southern regions. There is much food for study and discussion here presented. The proposed disposition of the geese of the *Branta canadensis* complex probably will receive extended consideration since these birds have given a great deal of trouble to taxonomists, few of whom have been able to agree on a satisfactory arrangement.—J. T. Zimmer.

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[1] Hellmayr, Charles E., and Conover, Boardman. 'Catalogue of birds of the Americas and the adjacent islands in Field Museum of Natural History . . . Part 1, Number 2. Spheniscidae—Gaviidae—Colymbidae—Diomedeidae—Procellariidae—Hydrobatidae—Pelecanoididae—Phaethontidae—Pelecanidae—Sulidae—Phalacrocoracidae—Anhingidae—Fregatidae—Ardeidae—Cochleariidae—Ciconiidae—Threskiornithidae—Phoenicopteridae—Anhimidae—Anatidae.' Field Mus. Nat. Hist. Zool. Ser., 13 (pt. 1, no. 2): I–VII, 1–434, Aug. 18, 1948.

Territory in bird life.[1]—Although the existence of "territory" as a factor in the lives of birds was noted more or less casually several centuries ago, it remained for Eliot Howard to appreciate the full significance of the phenomenon and to express a detailed opinion in his classical book, a reprint of which is here offered. Except for a special introduction by Julian Huxley and James Fisher, the text is that of the original.

Originally published in 1920 (*cf.* review in The Auk, 38: 288–290, April, 1921) the book has long been out of print and inaccessible to many students who may have wished to have a copy on their shelves. It is now made available at a very modest price. Some of Howard's views have been challenged, whether successfully or not, in the intervening years and some have been strengthened and amplified, but there is no doubt that his thesis gave a marked impetus to, if it did not open, this line of thought and study, and its importance is of the first order. It should be read by everyone who has an interest in the lives of birds.—J. T. Zimmer.

Oceanic birds of South America.[2]—This outstanding work was originally published in 1936 by the American Museum of Natural History (*see* review in The Auk, 53: 234–236, April, 1946), but has long been out of print. It is therefore gratifying to have it reprinted by The Macmillan Company and thus made available to many persons who have been unable to obtain copies of the original work.

The present issue has been prepared by offset printing and the general text, therefore, is identical with the original. The preliminary pages have been reset, with the name of The Macmillan Company naturally added to the title-page, while the date of publication has been omitted. The list of illustrations has been broken up so that each volume has its own, and the page-references to the plates have been omitted since all the plates, colored and half-tone, have been brought together at the close of their respective volumes.

Of the nature and content of the book there is no need to speak here since no changes have been made in its text. It remains the standard work on its subject that it became on its first appearance, and the new edition should make it available to a widening circle of readers and consultants.—J. T. Zimmer.

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[1] Howard, Eliot. 'Territory in Bird Life.' Demy 8vo, pp. 1–224, 11 pls., 2 figs., August 9, 1948. Collins, London. Price, 10s 6d.

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OBITUARIES

WALTER EDWARD COLLINGE, Corresponding Fellow of the American Ornithologists' Union from 1918, was the greatest economic ornithologist the British Isles have produced. His publications in this field, issued from 1906 to 1941, totalled about 170, of which two were books. While he shared and eloquently expressed the conservation point of view, he was a true economic biologist and advocated effective control of seriously injurious species. He made it clear that indiscriminate protection defeats its own ends by tending to make agriculturists, who must have relief from the depredations of certain species, hostile to all birds. He dealt especially with the economic relations of species injurious to husbandry, as the Rook, Bullfinch, Pheasant, House-Sparrow, and Starling, but, in time, took up the study of all species for which he could obtain material.

In his early work, Dr. Collinge followed the fashion in his country of using the numerical system for recording the results of bird stomach analyses. About 1914, however, realizing the superiority of the volumetric method, he re-examined all of his previously worked material—some thousands of specimens. Summarization of the results appeared in book form in 'The Food of Some British Wild Birds' (First Edition, London, 1913, vii + 109 pp.; and Second Edition, York, 1924–1927, xxi + 427 pp.). The latter text (reviewed in The Auk, April, 1927) contains a portrait of the author and one of Professor F. E. L. Beal to whose memory the work is dedicated. Professor Beal, our revered Nestor of this realm of biological investigation, was hailed as "the most brilliant economic ornithologist of his day, whose writings have been an incentive and a source of inspiration to all who have followed him." In addition to accounts of the food habits of kinds of birds, Dr. Collinge wrote on broader topics, as the relation of birds to forestry, the attacks of birds upon fruit, sea-birds—their relation to the fisheries and agriculture, the destruction and dispersal of weed seeds by birds, the rate of digestion of various species, the value of the different methods of estimating the stomach contents of wild birds, the need of a bird census, the citizen and wild birds, and the necessity of State action for the protection of wild birds.

He urged the establishment of a public, and preferably national, organization for the study of economic biology and cited the U. S. Biological Survey as a model. His hopes were never fully realized though 'The British Trust for Ornithology' is an approach to them. It came too late, however, to benefit him, or more correctly for it to profit from his participation, which would have been invaluable.

It should not be forgotten that Dr. Collinge's crusade for the scientific management of Britain's wildlife was a largely personal one, supported by occasional grants in aid and by the help of friends. The results are a monument to his earnestness, industry, and public spirit. The record is remarkable—no less—but it reflects only one side of a varied and always productive career.

He held the degrees of Master of Science from the University of Birmingham and of Doctor of Science from that of Saint Andrews. At the latter institution, he was Demonstrator in Biology and lectured on comparative embryology, and at Birmingham on economic zoology and comparative anatomy. He was Keeper of the Yorkshire Museum, at York, 1921–1941. The Yorkshire Evening Press (Nov. 25, 1947) noted that "Under his able and experienced guidance . . . the Museum has become one of the finest in the provinces, attracting investigators and students from all parts of the world."

Among recognitions accorded him were those of: Woodall Fisheries Prizeman, the

Darwin Gold Medal, Walker Trust Research Scholarship, and Carnegie Fellowship. He was for many years President of the Midland Malacological Society (establishing the Journal of Malacology in 1890), he was an Honorary Secretary of the Association of Economic Biologists (serving for a period as Editor of the Journal of Economic Biology), and General Secretary and Editor of the Wild Bird Investigations Society. He was a Foreign Member of the American Association of Economic Entomologists (being author of a 'Manual of Injurious Insects'), Honorary Fellow of the Royal Horticultural Society, Member of the Scottish Wild Bird Protection Advisory Committee, Member of the British Ornithologists' Union, Fellow of the Society of Antiquaries, and Fellow of the Linnaean Society of London. He was the originator of the Yorkshire Branch of the English Speaking Union, and local secretary for a number of scientific and technical organizations when they held their meetings at the Yorkshire Museum. Truly a varied experience.

Dr. Collinge always paid full attention to the bibliography of his studies and his own publications on economic ornithology are rather completely cited especially in the 1924–1927 book. But in addition to writings in the usual journals, he was a frequent contributor on natural history to newspapers, and took an active part in education, through lectures at the Yorkshire Museum. He was retired in 1941 but in reporting the event, wrote: "Yes after 50 years labour, mostly devoted to Economic Biology, I have retired and am now a poor man with no pension." What a reproach to current civilization!

There have been few in recent times so well qualified as Dr. Collinge to be awarded the honorable title of 'naturalist.' That he was a good and loyal friend I can appreciatively testify from a correspondence that began in 1913, was stimulated by personal communion in 1927, and continued into the year of his death.

In retirement, he dealt principally with the terrestrial and fresh-water isopods. In April, 1946, he wrote: "I am still very busy on my studies . . . [of these animals] and although entering upon my 80th year, I manage to put in 7 or 8 hours work daily." He published several brief papers on the biology and genetics of the woodlice, but difficulties as to printing prevented the publication of a longer composition in this field as well as another book he had planned on 'The Interrelations of Wild Birds and Insects.' Science and the world lost more by their non-appearance than did Dr. Collinge. No further luster was needed to mark his outstanding career of devoted service and sound achievement.

He was born at Huddersfield, April 19, 1867, and died from apoplexy at York, England, November 24, 1947. Interment was in Fulford Cemetery, York. He is survived by a daughter, Edie M. (Mrs. Dalton Garbutt) and by Mrs. Collinge whom he married as Maude Hamilton, July 28, 1897.—W. L. McAtee.

Franklin Lorenzo Burns, a Member of the American Ornithologists' Union, died at Berwyn, Pennsylvania, February 7, 1946, at the age of 77. He was born near Berwyn, Chester Co., January 18, 1869, and at an early age began to collect eggs. During the rest of his life his spare time was devoted mainly to the study of the habits of the birds of his native county. His concentration on the birds of Chester County, in southeastern Pennsylvania, was as marked as was that of J. Warren Jacobs on the birds of Greene County in the southwestern part of the state. But Burns's work was confined mainly to the eastern and southern portions and did not cover the entire area of the county (*see* Stone, Auk, 27: 155–156, 1920).

Burns was a Founder of the Wilson Ornithological Club and served as Secretary in 1906 and as President from 1909 to 1911. He was elected an Associate of the A. O. U. in 1891 and a Member in 1901. He contributed occasional short notes to The

Auk and the Bulletin of the Wilson Ornithological Club. Among his other publications of merit, special mention should be made of three monographs—on the Crow, 1895; Flicker, 1900; and Broad-winged Hawk, 1912; a series of eight papers on Alexander Wilson, 1908–1910, a bibliography of minor ornithological publications published as a supplement to The Oologist, July, 1915; the 'Ornithology of Chester County, Pa.,' 1919; and his autobiography, 1926. All of these except the bibliography and the 'Ornithology of Chester County' appeared in the Wilson Bulletin. His series of eight papers on Alexander Wilson, inspired by the conviction that an impartial biography of Wilson had never been written, shows remarkable familiarity with practically everything that had been published on the subject up to that time. His autobiography, however, written at the age of 57, does not include the last 20 years of his own life.—T. S. PALMER.

BENJAMIN TRUE GAULT, a Member of the American Ornithologists' Union, was born in Decatur, Illinois, on November 2, 1858. His father, James C. Gault, one of the original 'Forty-niners,' and his mother, Mary T. (Dudley), were from New Hampshire, with distinguished colonial ancestry. They came to Illinois in 1854, returned to New Hampshire for a brief period, came back to Illinois in 1866, and moved to Glen Ellyn, Illinois, in 1890. The father died in 1905; the mother in 1924. Of their six children, only Benjamin survived.

Benjamin seems not to have had an extended formal education, nor to have engaged in any routine income-producing activity. When he was eight years old, his father gave him a little book on natural history which he evidently enjoyed and cherished; it was found in his library after his death. This book may have been the stimulus for his lifelong interest in nature.

In 1902 he accompanied George K. Cherrie on an expedition to French Guiana which was terminated after four months by Cherrie's illness. The birds collected were reported upon by Berlepsch in the Novitates Zoologicae, 15: 103–164, 261–324, 1908, and are now in the Rothschild Collection in the American Museum of Natural History. He was offered a position by Field Museum of Natural History to work further in South America but refused because of unwillingness to leave his mother alone. He remained, until her death, in Illinois, busying himself in making notes on the local bird life, assembling a library of nature books and periodicals, attending meetings of the societies of which he was a member, and mounting birds that he collected.

After his mother's death, he stored his belongings and made an extended visit to Ireland where he remained for two years, hunting, fishing, photographing, collecting specimens, and filling his notebooks. A collection of badgers that he made at this time he later sold to the Museum of Comparative Zoölogy, Cambridge, Massachusetts.

After his return to America, he gave a number of lectures, illustrated with his own photographs, and resumed his former quiet occupation of keeping notes and attending meetings. The Park Board of Glen Ellyn purchased an area of ravine-land in the village that was named the Benjamin Gault Bird Sanctuary, and he took great pride in stocking it with native trees and wild flowers. His health failed and for a number of years he was in financial difficulties before he died on March 20, 1942. He was buried in Forest Hill Cemetery where his grave is marked with two great boulders, weathered and lichen-covered, brought from the Morton Arboretum, and planted with Waukegan juniper and hawthorn.

Benjamin Gault joined the American Ornithologists' Union in 1885 and was elected a Member in 1903. In addition, he belonged to the Wilson Ornithological Club, the

Cooper Ornithological Club, Illinois Audubon Society (of which he was at one time a Director and later Honorary Member), American Society of Mammalogists, and the Kennicott Club, and was made an honorary member of the local Izaak Walton League. He was author of a 'Check-List of the Birds of Illinois,' published by the Illinois Audubon Society in 1922, and of a number of current notes published in The Auk and other journals. He also supplied local notes for various other authors who availed themselves of his fund of information. He was modest and unassuming but well-informed and helpful, and left a host of friends who mourned his passing.—AUDRIE ALSPAUGH CHASE.

ALDO LEOPOLD, who became an Associate of the American Ornithologists' Union in 1929 and a Member in 1935, was born at Burlington, Iowa, on January 11, 1886. Both of his grandfathers came to the United States from Germany. He was educated at Lawrenceville Preparatory School and Sheffield Scientific School at Yale, the latter granting him the degree of Master of Forestry in 1909. Following graduation he entered the U. S. Forest Service and served in New Mexico and Arizona from 1909–1924 in various positions from Forest Assistant to Assistant District Forester. From 1925–1927 he was Associate Director of the Forest Products Laboratory at Madison. A game survey of the north-central states, conducted for the Sporting Arms and Ammunition Manufacturers' Institute from 1928–1931, gave direction to his future activity.

As a boy he was intensely interested in ornithology and inherited from his father a fondness for hunting. He was unique among foresters in his broad vision of land use. Preservation of the flora, fauna, and soil went hand in hand, "useless each without the other." The experience gained in game protection in New Mexico and in the game surveys resulted in the publication, in 1933, of 'Game Management,' the first modern book on the subject. In this year he became Professor of Wildlife Management at the University of Wisconsin, a position held until his death. The Wisconsin Conservation Commission, on which he served since 1943, found him a very stimulating member.

Honors in the form of the presidency of societies, chairmanship of committees, and medals were many. Shortly before his death he was requested by Secretary of State Marshall to serve as Discussion Chairman of the Inter-American Conference on Conservation of Renewable Resources, and by Secretary of the Interior Krug to serve on the Advisory Committee on American Participation at the United Nations' Scientific Conference on Conservation and Utilization of Resources.

A bibliography of approximately 300 titles speaks of his monumental effort to mold public opinion in all phases of conservation. The skulking fox, the booming prairie chicken, the yellow lady's slipper, were all entitled to preservation if for no other reason than aesthetic. Raising game in pens for liberation on unsuitable terrain was an undignified procedure. Restore to the land the natural food and cover and game could declare its independence.

A decade of effort on his part resulted in the establishment, by the Forest Service, of Primitive Areas. His love for the unspoiled wilderness and his zeal for its preservation was most appealing. In this he had close kinship with John Muir. But unlike the latter he had a scientific approach to problems in nature. Data must not only prove a phenomenon but form the basis for a philosophical deduction.

Aldo Leopold died on April 21, 1948, while fighting a marsh fire near his cabin on the Wisconsin River, nine miles west of Portage. The end was in harmony with lifelong endeavors. He was interred in the Aspen Grove Cemetery at the place of his birth. He was married on October 9, 1912, to Estella Luna Bergere who survives

him. His two daughters and three sons are trained and active in the natural sciences. This in itself is a great achievement.—A. W. SCHORGER.

JANE SHIELD ELLIOTT (MRS. NORMAN THOMAS ELLIOTT), an Associate of the American Ornithologists' Union, died January 2, 1946 at the age of nearly 78, at South Norwalk, Connecticut, while on a visit to her daughter. She was born in Washington, D. C. March 1, 1868, and graduated from the high school in Washington in the class of 1887. She was employed in the Biological Survey in the U. S. Department of Agriculture for 22 years until her retirement in 1939.

Mrs. Elliott was an artist of considerable ability. Her principal work included making diagrams and maps to illustrate the publications of the Bureau and the preparation of a much larger series of reference maps showing the distribution of mammals and birds. These maps were executed with neatness and precision and she took great pride in making them as accurate as possible.

She was an Associate of the Union for 24 years, having been elected in 1921, and she was also a member of the American Society of Mammalogists. For 30 years she was head of the primary department of the Washington Heights Presbyterian church, and a Founder and first President of the Cultus Club. She was also active in the 20th Century Club of Washington, and in local D. A. R. work, and had served as Regent of the Dolly Madison Chapter. She was survived by her daughter Mrs. Frederick G. Nelson of South Norwalk and a brother, James Van Allen Shields of Ridgefield, Connecticut.—T. S. PALMER.

ALLEN FROST, an Associate of the American Ornithologists' Union since 1919, died January 9, 1946, in his 69th year, at his home in the city of Poughkeepsie, New York, where he was born on July 17, 1878. He was a direct descendant of Governor Winthrop of the Massachusetts Bay Colony and the family of Nathan Hale. After a preparatory education at the old Riverview Academy, means were lacking to realize his early ambition for medicine, and he entered business, first in local banks and later as an officer of the Trussell Manufacturing Company. A childhood love of nature and outdoors developed in maturer years to an absorbing interest in ornithology, to which he devoted an increasing amount of leisure time and energy. He became a leader in every Dutchess County activity connected with natural history, and the well-loved friend of every like-minded person. No one was a more zealous lieutenant to the late Maunsell S. Crosby in his studies for a book on the birds of the county. It was through Crosby that I first met Frost, and we became intimate friends and field companions; at this date it is impossible to count the number of trips I had with Crosby and Frost. Frost was a gifted and cautious field observer, and deafness in the later years of his life was a great cross to him.

Frost retired from business in 1927, and served as Curator and President of the Vassar Institute. He joined the staff of the Franklin D. Roosevelt library in 1941. He was active in many county activities, the Boy Scouts, the county Historical Society, and other civic and church affairs. He always felt keenly his amateur status and lack of technical training. This made him reluctant to publish anything but a few notes and short articles, so he freely turned over to others the fruits of long years of experience and study. Modest, unassuming and self-effacing, he had the two great gifts of capacity for loyal friendship and the ability to arouse and retain for life the same feeling in others. A simple, unaffected gentleman in an old American tradition, he lived to be widely known, honored, and esteemed in his home community. He probably would have been astounded, could he have read the obituary notices and editorials in the local papers after his death. I am grateful to another

old and mutual friend, Mr. Raymond G. Guernsey, of Poughkeepsie, for most of the data in this account.—Ludlow Griscom.

William Ellery Hughes, an Associate of the American Ornithologists' Union, died in Philadelphia, Pennsylvania, March 16, 1944, at the age of 87. He was born in Phoenixville, Pennsylvania, in 1857, and received his degree from the Medical School of the University of Pennsylvania in 1880. Following his interneship at the Philadelphia General Hospital and the Children's Hospital, he engaged in active practice for more than 60 years. He was consulting physician to the Philadelphia General Hospital, Misericordian Hospital, and the Presbyterian Hospital, and was Professor of Clinical Medicine of the Medico-Chirurgical College faculty for a number of years. As a physician, Dr. Hughes was widely known as one of the foremost diagnosticians of the East and as a physician's physician he had treated more doctors and doctors' families than any other Philadelphia physician.

Dr. Hughes joined the Delaware Valley Ornithological Club in 1891, and the American Ornithologists' Union in 1920. His chief hobby was travel, and in the course of years he had visited many foreign countries. In 1891 he accompanied Robert E. Peary on one of his North Polar expeditions, and about 1921 went to the Fiji Islands in the South Pacific.—T. S. Palmer.

Herbert Newby McCoy, an Associate of the American Ornithologists' Union, elected in 1930, died in Los Angeles, California, May 7, 1945, at the age of about 75. He was born in Richmond, Indiana, June 20, 1870, the son of James Wellington and Sarah Newby McCoy. It was his intention to study zoology under David Starr Jordan at the University of Indiana, but after the removal of Dr. Jordan to Stanford University, McCoy changed his plans and entered Purdue University as a student of chemistry. He received the degree of B.S. in 1892, M.S. in 1893, and in 1898, Ph.D., the last from the University of Chicago. After successfully carrying on his professional work as a chemist for some years, he retired about 1928 and moved to Los Angeles where he devoted much of his time to studying birds and mammals. He made frequent trips to the mountains and near-by deserts, and in 1932 made a collecting trip to Guatemala.

McCoy was a member of the Cooper Ornithological Club as well as of the A. O. U., and served as President of the Southern Division in 1938, and also as a member of the Board of Governors. His publications, numbering 40 or more, were on organic amalgams, radioactivity and other chemical subjects. More extended accounts of his activities may be found in Chemical Bulletins, 24 (5): 171–174, 1937, and a notice by George Willett in 'The Condor' for May, 1945, pp. 174–175. The latter is illustrated by a portrait and is the source of the information here given.—T. S. Palmer.

Edward Ludlow Parker, a Life Associate of the American Ornithologists' Union since 1916, was born in Plymouth, Massachusetts, April 20, 1860. In 1902, he moved to Concord, Massachusetts, where he lived the remainder of his life. He died on September 12, 1925 at the age of 65.

Mr. Parker's paternal ancestor came from England in 1635; his maternal ancestry goes back to Elder Brewster of the Company of the Mayflower. Brought up in the hotel business, he soon turned to accounting and became a certified public accountant in 1909, attaining high skill in his profession which he practiced for the rest of his life.

In reading the account of his life, we learn of Mr. Parker's interest in natural history: "He was a lover of wild life, and particularly of birds. When very small, he was taken gunning by his father; and for a number of years he was fond of shooting,

in a time when the wild birds of Massachusetts were plentiful. At the age of forty, however, his attention was called to the slaughter of gulls and terns, and he then and there became a bird-protectionist. At Concord he was fond of feeding the winter birds; he planted his shrubbery and windbreaks partly for their food and nesting; and he was interested in watching his birdhouses, to which the martins came each spring.

"He was as fond of his books as of the birds. It was characteristic of him that he was a careful and thoughtful reader. In all his personal relations Edward Parker was of a serious cheerfulness. He liked his joke; he enjoyed his penetrating and not unsympathetic study of the people and things around him. His approach to any new subject was scientific and thorough."

We learn these facts from a brief notice of Mr. Parker's life published in 'Memoirs of Members of the Social Circle in Concord,' 1940, and written by Allen French.—W. M. Tyler.

Charles Lincoln Phillips, an Associate of The American Ornithologists' Union since 1912, died in Taunton, Massachusetts, on November 28, 1946. He was born in Dighton, Massachusetts, April 27, 1868, and had been associated with the New York, New Haven and Hartford Railroad for nearly half a century, during twenty-five years holding the position of travelling auditor. He retired in 1931.

For the following fifteen years he and his wife, who shared his interest in natural history, spent the winters in Sarasota, Florida, where he was able to concentrate on the study of wild life which had been his lifelong hobby. His collection of bird skins, assembled over the course of years, numbered 2000. He also collected shells and butterflies, and was a painter in watercolors of some ability.

He published ten general notes in 'The Auk.' Three of these were of more than passing interest, *viz.*: Report of a Flicker which laid 71 eggs in 73 days (mentioned in Bent's Life Histories); the occurrence of an Acadian Sharp-tailed Sparrow at Plymouth, Mass., in mid-winter; and a Clay-colored Sparrow collected in Florida. From two of his notes we learn that he visited Colorado in 1928, and Canada in 1939.

Mr. Phillips's articles are written carefully and with painstaking accuracy, leaving us with a pleasant impression of the author as a gentleman enjoying the out-of-doors and faithfully recording his discoveries in his chosen avocation.—W. M. Tyler.

John W. Sugden was born at Salt Lake City on June 29, 1896. He died at Phoenix, Arizona, while on a trip, March 19, 1947. Between these two dates lies the story of a very interesting life during which he not only ministered to his clientele as a medical doctor but also contributed significantly to Utah ornithology.

He was educated in Salt Lake City schools, the University of Utah, and Rush Medical School in Chicago. He married Roberta Edmonds in 1920 and they had three children.

Dr. Sugden's father, John W. Sugden (1867–1935) was born in England but came to Utah at two years of age. In Utah, he became interested in a nature hobby which he learned from his father who had been a casual devotee of butterfly collecting before he left England. From butterflies and other insects, Mr. Sugden spread to collecting birds' eggs and nests about 1895. He received much encouragement at the old Deseret Museum. He collected because of genuine interest and did not indulge in the commercialism that was so rampant in his day. He never sold a specimen as long as he lived but he did launch a series of exchanges with naturalists in many places and added many exotic specimens to his local collections.

Dr. John W. Sugden grew up in an atmosphere of keen interest in these naturalistic hobbies of his father. His university training added further zest to his youthful enthusiasm and he continued work with the collection after it passed to him from his

father. He tried to make it useful to science. He became a member of the American Ornithologists' Union, the Cooper Club and the Audubon Society and contributed articles for publication. The writer first met Dr. Sugden in 1927 at a meeting of the Cooper Club held at the home of his father where the Sugden collection was the theme of discussion. Close friendship that developed around a common interest in birds during the next four years led to an agreement in 1931 to undertake a comprehensive study of the birds of Utah. Thereafter, much of Dr. Sugden's spare time was directed toward gathering data for that purpose. In 1936, our efforts were consolidated with those of Dr. Clarence Cottam, of the U. S. Fish and Wildlife Service, who had been directing efforts toward the same end.

Dr. Sugden was an excellent photographer and almost always carried cameras with him on field trips. He accumulated, in addition to his many breeding records, large numbers of pictures of birds, many of which are to be used in the forthcoming book on 'The Birds of Utah.'—ANGUS M. WOODBURY.

JOHN WANLESS, an Associate of the American Ornithologists' Union from 1928 to 1940, died at Toronto, Ontario, July 15, 1941. He was born in Toronto, August 28, 1862. Mr. Wanless became a leading member of the political and business life of the city. He was proprietor of one of the leading jewelry establishments at 243 Yonge Street (founded in 1840 by his father, John) and was a councillor in York Township, an alderman of the City Council (1912–1914), and a trustee of the Board of Education (1923–1926). He was for two years Chairman of the Board's finance committee, and served also, for a time, in the city's Treasury Department.

Mr. Wanless had varied interests. Educated at Canon Dixon's private school and the Normal Model School, he later obtained degrees in commerce, law and natural history, under private tutors and at the British American College of Commerce, Toronto, and the American Law School, Chicago.

Although he was a lifelong student of natural science, he did not write anything in ornithology or identify himself actively with local natural history activity. He belonged to the American Genetic Association, the American Association for the Advancement of Science, and the Toronto Field-Naturalists' Club, besides the A. O. U. Other interests included systematic theology and apologetics. John Wanless Public School, Wanless Avenue, and Wanless Crescent, Toronto, bear his name and indicate the esteem in which he was held by his political associates.

His two sons predeceased him. His portrait, painted by Dr. George Berthon in 1883, is in existence in Toronto.—J. L. BAILLIE, JR.

FRANCIS BEACH WHITE, Member of the American Ornithologists' Union since 1925, died January 17, 1948, at the age of 75. He was born in Cambridge, Massachusetts, August 20, 1872, one of three sons of John Gardner and Mary (Beach) White. He prepared at Noble and Greenough School in Boston and was graduated from Harvard College in 1894, receiving its A.M. degree the following year, specializing in English literature. That year his father died and he began the teaching career in St. Paul's School, Concord, N. H., which was his life work until his retirement in 1942, when his love of the school led him to buy a house on Silk Farm Road near the shore of Big Turkey Pond.

No teacher in the past generation was so greatly loved as he as house master and head of the school department of English. He never married but gave to the boys of the school and to his intimate friends the love and loyalty which might have gone to wife and children. His greatest enthusiasms were for the Puritan inheritance and for the New England scene. For these, as for the poetry of Wordsworth and Milton, of Keats, Browning and Shelley, he had an enduring passion which he was able to transmit to others.

The possession of the octavo Audubon led him as a boy to the study of birds, and when he was 15, with his neighbors, Rodman Peabody, Robert Walcott and James Whittemore, he founded the Wilson Ornithological Club which kept the interest of its members until they joined the Nuttall Club of which, during his last year in Cambridge, White was the Secretary, and for many years thereafter a member of the Council, never permitting the journey from Concord to hinder his attendance.

From the beginning of his residence at Concord, N. H., White gave careful attention to the birds of that territory; the results he published in a 'Preliminary List of the Birds of Concord, N. H.' printed at his expense, an indispensable aid for the bird lover in that location and a joy to all who appreciate accurate observation and lucid yet poetic English.

He was a member of the American Association for the Advancement of Science and Massachusetts Audubon Society, Vice-President of the New Hampshire Audubon Society and Past President of the New England Bird-Banding Society.—ROBERT WALCOTT.

NOTES AND NEWS

THE Editor wishes to announce that, due to increasingly heavy demands on his time, he has felt obliged to tender his resignation to the Council of the A. O. U. to take effect at the completion of the current volume of The Auk. He takes this occation to thank the many contributors during his term of office who have co-operated in his effort to make the journal a record of study and observation in the field of ornithology, and who have been sparing of criticism for its shortcomings. It is with genuine regret that he withdraws from the post.

At the time of going to press it is impossible to announce the new Editor who is to be elected at the forthcoming annual meeting, although it may be a matter of record by the time these pages are read. Prospective contributors are asked to withhold their manuscripts until details are available. An early effort will be made to advise the editors of publications on the exchange list of the new address. *Personal exchanges* of the retiring editor will still be welcomed at his current address which has not been altered.

Editorial thanks are again due to Dr. and Mrs. Charles Vaurie for their generous assistance in the preparation of the section of 'Periodical Literature,' and to Miss Constance Sherman for the compilation of the annual 'Index' and other efficient secretarial help.

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